JULY 2001
ISSUE #488
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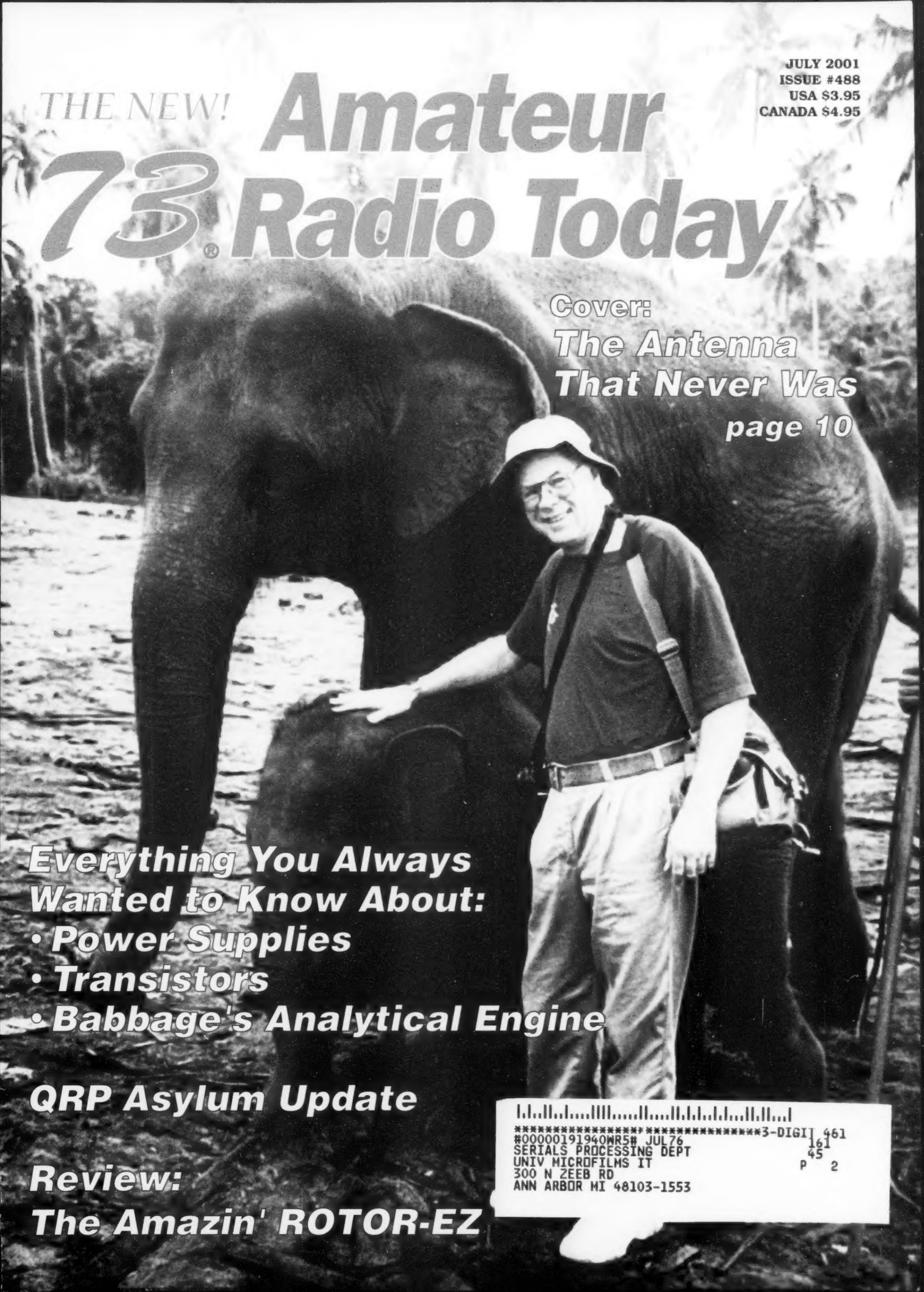
THE NEW!

73® Amateur Radio Today



Cover:
The Antenna That Never Was
page 10

Everything You Always Wanted to Know About:
- Power Supplies
- Transistors
- Babbage's Analytical Engine

QRP Asylum Update

Review:
The Amazin' ROTOR-EZ

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JULY 2001
ISSUE #488

THE NEW!

73 Amateur Radio Today

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Contributing Culprits
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Advertising Sales
Evelyn Garrison WS7A
21704 S.E. 35th St.
Issaquah WA 98029
425-557-9611
Fax: 425-557-9612

Circulation
Frances Hyvarinen

Data Entry & Other Stuff
Norman Marion

Business Office
Editorial - Advertising - Circulation
Feedback - Product Reviews
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70 Hancock Rd.
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Ham Radio In Space: Tito Comes Home

Dennis Tito KG6FZX and two companion Russian cosmonauts landed on May 5th at 05:41 UTC near Astana, Kazakhstan. On landing, the ham radio space traveler was quoted as saying his stay on the International Space Station was a personal experience that went well beyond his dreams.

Tito, who reportedly paid the Russians $20 million for the flight, and his fellow flyers Talgat Musabayev and Yuri Baturin were each given an apple. The apple is a national symbol in Kazakhstan and is traditionally presented to cosmonauts returning from space.

During his visit, KG6FZX was hosted by Russian commander Yury Usachev UA9AD, along with U.S. astronauts Susan Helms KC7NHZ and Jim Voss. But Tito's voyage to the ISS is not without continued controversy. Former U.S. senator and astronaut John Glenn, who himself returned to space at age 77, told the Cable News Network on Saturday the 5th that he believed Tito's trip was a misuse of the spacecraft. This, because Glenn believes that the ISS is supposed to be for research.

But Yuri Semyonov, whose RSS Energiya corporation built Russia's segments of the ISS, says that his nation is satisfied with this flight. And rumors continue

Continued on page 6

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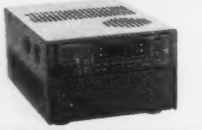
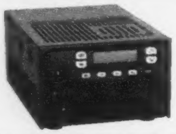

MODEL SS-10TK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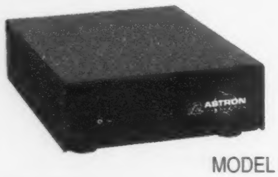
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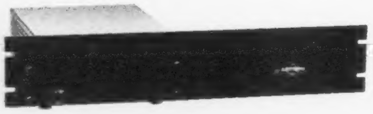
SS-12	10	12	1⅜ x 6 x 9	3.4
SS-18	15	18	1⅜ x 6 x 9	3.6
SS-25	20	25	2⅞ x 7 x 9⅜	4.2
SS-30	25	30	3¾ x 7 x 9⅝	5.0

MODEL SS-25M

DESKTOP SWITCHING POWER SUPPLIES WITH VOLT AND AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SS-25M*	20	25	2⅞ x 7 x 9⅜	4.2
SS-30M*	25	30	3¾ x 7 x 9⅝	5.0

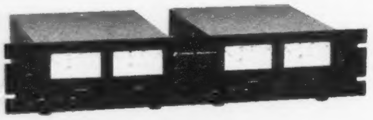

MODEL SRM-30

RACKMOUNT SWITCHING POWER SUPPLIES

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25	20	25	3½ x 19 x 9⅜	6.5
SRM-30	25	30	3½ x 19 x 9⅝	7.0

WITH SEPARATE VOLT & AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25M	20	25	3½ x 19 x 9⅜	6.5
SRM-30M	25	30	3½ x 19 x 9⅝	7.0

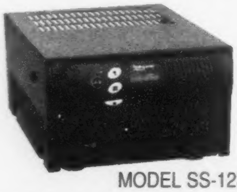

MODEL SRM-30M-2

2 ea SWITCHING POWER SUPPLIES ON ONE RACK PANEL

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25-2	20	25	3½ x 19 x 9⅜	10.5
SRM-30-2	25	30	3½ x 19 x 9⅝	11.0

WITH SEPARATE VOLT & AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25M-2	20	25	3½ x 19 x 9⅜	10.5
SRM-30M-2	25	30	3½ x 19 x 9⅝	11.0


MODEL SS-12SM/GTX

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EF JOHNSON GT-ML83	SS-18EFJ
EF JOHNSON 9800 SERIES	SS-10-EFJ-98, SS-12-EFJ-98, SS-18-EFJ-98
GE MARC SERIES	SS-12MC
GE MONOGRAM SERIES & MAXON SM-4000 SERIES	SS-10MG, SS-12MG
ICOM IC-F11020 & IC-F2020	SS-101F, SS-121F
KENWOOD TK760, 762, 840, 860, 940, 941	SS-10TK
KENWOOD TK760H, 762H	SS-12TK OR SS-18TK
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MOTOROLA HIGH POWER SM50, SM120, & GTX	SS-10SM/GTX, SS-12SM/GTX, SS-18SM/GTX
MOTOROLA RADIUS & GM 300	SS-10RA
MOTOROLA RADIUS & GM 300	SS-12RA
MOTOROLA RADIUS & GM 300	SS-18RA
UNIDEN SMH1525, SMU4525	SS-10SMU, SS-12SMU, SS-18SMU
VERTEX — FTL-1011, FT-1011, FT-2011, FT-7011	SS-10V, SS-12V, SS-18V

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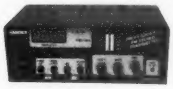
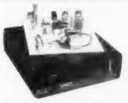


- Synthesized 88 to 108 MHz for no frequency drift !
- Built in mixer – 2 line inputs and one microphone input!
- Strappable for higher power output
- Low pass filter for great audio

Our FM100 is used all over the world by serious hobbyists as well as churches, drive in theaters, and schools. The kit includes metal case, whip antenna and built-in 110 volt AC power supply.

FM100	**Super-Pro FM Stereo Radio Station Kit**	**$249.95**
FM100WT	**1 Watt, Wired Export Version**	**$399.95**

FM STEREO RADIO TRANSMITTER



Great entry level FM broadcast kit. Thousands in use. Handy for sending music through house and yard, ideal for school projects too – you'll be amazed at the exceptional audio quality! Runs on 9V battery or 5 to 15 VDC. Add matching case and whip antenna set for great pro look.

FM10A	**Tunable FM Stereo Transmitter Kit**	**$34.95**
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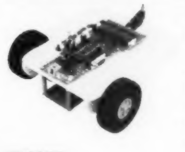
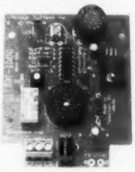
CARPET ROVER II ROBOT KIT



This advanced kit is an 8 x 8" differentially steered base that is excellent for carpet or tiled floor experimentation. It uses the Next Step microcontroller, a BASIC Stamp 2 controller that can use the BS2 or BS2-E (sold separately). A host PC is required to download programs to the robot. This complete kit includes the Rover, programming cable, IR proximity detector, bumper switch kit, and line follower kit.

RK3000	**Carpet Rover II Complete Kit**	**$185.00**

COMBUSTIBLE GAS DETECTOR KIT



Build this kit and detect combustible gases and vapors including natural gas, gasoline, propane, and dozens more. Model GLD1000 is a local alarm only, GLD1010 includes a relay to control external alarms.

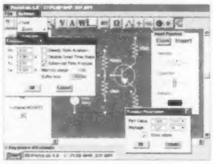
GLD1000	**$29.95**
GLD1010	**$39.95**

BUILD YOUR OWN STEREO!

We've got the kit! Our K4500 is a synthesized FM stereo tuner, the K4100 is a matching preamp. Both are fully digitally controlled with an optional IR remote control (kit also). Add our K4020 2 x 155W Class A power amplifier kit to complete your drop-dead stereo. We also have tube amplifier kits. Visit us on the web, or request our new catalog for more information.

K4500	**Synthesized FM Stereo Tuner Kit**	**$399.99**
K4100	**Digital Preamp Kit**	**$399.99**
K4101	**IR Remote Control Kit**	**$69.95**
K4020	**Solid State 310W Power Amp Kit**	**$499.99**

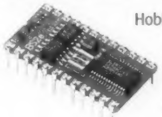
ELECTRONIC PROTOTYPING SOFTWARE...



Priced for the hobbyist!
You can create and test AC and DC circuits minutes after installing this package on your PC. Start from scratch, or from the included library of pre-designed circuits. Drag and drop placement from a complete list of active and passive components. Test using a complete list of virtual instruments, Oscilloscope, voltmeter, ohmmeter, ammeter, and watt meter.

PLAB4	**$49.95**

RAMSEY NOW CARRIES BASIC STAMPS



Hobbyists and educators have embraced the Basic Stamp family of microcontrollers thanks to their power, ease of programming and simple interface. Ramsey now offers popular BS boards, kits, and trainers. If you've been wanting to learn microcontrollers, or build them into a project, now's the time!

BS1IC	**Basic Stamp I Module**	**$34.00**
BS2IC	**Basic Stamp II Module**	**$49.00**
27205	**Basic Stamp 1 Starter Kit**	**$109.00**
28150	**Board of Education Full Kit**	**$109.00**

MINI-KITS

These are easy to build kits that can be used either stand alone or as building blocks for more complex projects.

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TS1	**Touch Switch**	**$6.95**
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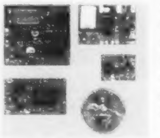

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TX433	**433 MHz Data Transmitter Mod., Assembled**	**$19.95**

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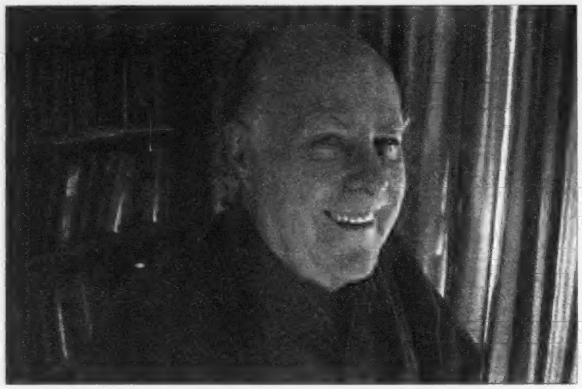

Wise Up & Beat the Odds

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Yeah, More Mooning

But not much more. Last month I mentioned NASA spokesman Brain Welch, but I didn't give you the gory details. He's the NASA representative who was on the Fox TV show which questioned the Moon landings back in February, and was repeated in March. Too bad if you missed this one. Now here's the rest of the story.

If you watched the show you know that Welch had no answers to the many questions raised by René, Bill Kaysing, and John Percy. His only answer was a defiant, "We went to the Moon and anyone who doesn't believe it is a nut case."

After the program was filmed, Welch went back to NASA, complaining that he was really embarrassed at not having any good answers for the questions raised, and that, by God, he was damned well going to get some answers. Two days later he died, at 42. Heart attack.

I did mention astronaut John Irwin, who had called Bill Kaysing on a Tuesday, explaining that he had become a born-again Christian and wanted to get together with him Thursday to ease his conscience. He died Wednesday. Another timely heart attack.

Just a coincidence, of course — like the death of the eleven astronauts in the few months back in 1967 when they would have had to agree to go along with the hoax.

I've got to stop making so much of these coincidences.

Birthdays

Mine's September 3rd, so naturally I looked through Rod McKuen's Birthday Book to see who else was born on my birthday. If there's anything to astrology, those people should be a lot like me, right? Well, sharing my birthday, according to Rod, are Hank Thompson, Charlie Sheen, Alan Ladd, Kitty Carlisle, Steve Boros, Freddy King, Valerie Perrine, Ferdinand Porsche, and Dixie Lee Ray.

Clearly proving that there's not much to astrology.

Ferdinand Porsche is the guy who designed the original VW bug. And then, later, the cars bearing his name. For a while I was buying Porsches every year or so, but I got over it. The old Porsche Speedster was the most fun car I've ever had. I'll bet I put over a hundred thousand miles on it, just on car rallies. My Jaguar was the most trouble, by a very wide margin. I love the look of the new bugs and their colors knock me out. I'm glad to see other car makers like Ford quickly imitating this new bug look.

Dixie Lee Ray was the governor of Washington, chairman of the Atomic Energy Commission, assistant secretary of state in the U.S. Bureau of Oceans, a zoology professor, and a winner of the United Nations Peace Prize. She's also the author of *Environmental Overkill*, which debunks the crapola Gore has been spreading about ecological disasters such as global warming, air pollution, endangered species, wetlands, overpopulation, etc. It's reviewed on p. 15 of my *Wisdom Guide*.

Yes, bless his heart, Rod even has me on his Birthday Book list.

Pigs is Pigs

When I went to Erasmus High in Brooklyn (NY), they had a booklet of recommended books to read. I naturally turned to the humor section, and listed there was *Pigs is Pigs*. It had to do with a Railway Express agent who received a freight collect shipment of two guinea pigs. The agent looked in the manual to see how much to charge, but could only find pigs listed, so he used that price. The customer looked at the bill and said hey, no way I'm going to pay that much for two little guinea pigs. The agent argued that, "Pigs is pigs." He sent word back to the home office asking for clarification.

Weeks went by with no response. The two guinea pigs turned into eight, then twenty. More weeks and a second generation was propagating, with the agent now dealing with hundreds of guinea pigs. Soon it was thousands.

I was reminded of this story when I read about scientists using pig organs for transplants. The problem is that the body's immune system immediately rejects the implant. That was only a small problem for doctors, who solved it by destroying the patient's immune system with very toxic drugs.

Their next approach, they decided, would be to take some bone marrow from you and inject it into a pig fetus before birth. Then, after they're born, some of their bone marrow cells could be removed and injected into you, making you like brother and sister, making the pig part human and you part pig. Theoretically it should work and genetic engineering will have done it again. Of course, it could have a side effect of giving you a strong desire to roll around in shit.

Hey, why bother to live a healthy life so you won't destroy your organs when genetic engineering will soon be solving the organ transplant problem? There are, by the way, 65,000 dying Americans who are desperately waiting for human organ transplants, but only a third of them will get one in time.

On the bright side, the Mayo Clinic, the best hospital in America, claims that 95% of their organ transplant patients live normal healthy lives for at least one year. What a fabulous success!

War and Peace

Why are we so warlike? I'll bet that you've never given it any serious thought. War is bad. Peace is good. Right?

Okay, now let's actually think about it.

I love walking around my north pasture every spring, with new wildflowers popping up almost every day. Every inch of the ground is contested. Vigorously contested. It's warfare at the plant level.

Continued on page 8

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Bearcat® 780XLT Trunk Tracker III

Mfg. suggested list price $529.95

Less -$190 Instant Rebate / Special $339.95

500 Channels • 10 banks • CTCSS/DCS • S Meter

Size: $7^{5/8}$" Wide x $6^{15/16}$" Deep x $2^{13/16}$" High

Frequency Coverage: 25.0000-512.0000 MHz., 806.000-823.9875MHz., 849.0125-868.9875 MHz., 894.0125-1300.000 MHz.

The Bearcat 780XLT has 500 channels and the widest frequency coverage of any Bearcat scanner ever. Packed with features such as Trunktracker III to cover EDACS, Motorola and EF Johnson systems, control channel only mode to allow you to automatically trunk certain systems by simply programming the control channel, S.A.M.E. weather alert, full-frequency display & backlit controls, built-in CTCSS/DCS to assign analog and digital subaudible tone codes to a specific frequency in memory, PC Control with RS232 port, Beep Alert, Record function, VFO control, menu-driven design, total channel control and much more. Our CEI package deal includes telescopic antenna, AC adapter, cigarette ligher cord, DC cord, mobile mounting bracket with screws, owner's manual, trunking frequency guide and one-year limited Uniden factory warranty. For maximum scanning enjoyment, order magnetic mount antenna part number ANTMMBNC for $29.95; The BC780XLT comes with AC adapter, telescopic antenna, owner's manual and one year limited Uniden warranty. Not compatible with AGEIS, ASTRO or ESAS systems. For fastest delivery, order on-line at www.usascan.com.

Bearcat® 895XLT Trunk Tracker

Mfg. suggested list price $499.95

Less -$320 Instant Rebate / Special $179.95

300 Channels • 10 banks • Built-in CTCSS • S Meter

Size: $10^{1/2}$" Wide x $7^{1/2}$" Deep x $3^{3/8}$" High

Frequency Coverage: 29.000-54.000 MHz., 108.000-174 MHz., 216.000-512.000 MHz., 806.000-823.995 MHz., 849.0125-868.995 MHz., 894.0125-956.000 MHz.

The Bearcat 895XLT is superb for intercepting trunked communications transmissions with features like TurboScan™ to search VHF channels at 100 steps per second. This base and mobile scanner is also ideal for intelligence professionals because it has a Signal Strength Meter, RS232C Port to allow computer-control of your scanner via optional hardware and 30 trunking channel indicator annunciators to show you real-time trunking activity for an entire trunking system. Other features include Auto Store - Automatically stores all active frequencies within the specified bank(s). Auto Recording - Lets you record channel activity from the scanner onto a tape recorder. CTCSS Tone Board (Continuous Tone Control Squelch System) allows the squelch to be broken during scanning only when a correct CTCSS tone is received. For maximum scanning enjoyment, order the following optional accessories: PS001 Cigarette lighter power cord for temporary operation from your vehicle's cigarette lighter $14.95; PS002 DC power cord - enables permanent operation from your vehicle's fuse box $14.95; MB001 Mobile mounting bracket $14.95; EX711 External speaker with mounting bracket & 10 feet of cable with plug attached $19.95. The BC895XLT comes with AC adapter, telescopic antenna, owner's manual and one year limited Uniden warranty. Not compatible with AGEIS, ASTRO, EDACS, ESAS or LTR systems.

Bearcat® 245XLT Trunk Tracker II

Mfg. suggested list price $429.95/**CEI price $189.95**

300 Channels • 10 banks • Trunk Scan and Scan Lists

Trunk Lockout • Trunk Delay • Cloning Capability

10 Priority Channels • Programmed Service Search

Size: $2^{1/2}$" Wide x $1^{3/4}$" Deep x 6" High

Frequency Coverage:

29.000-54,000 MHz., 108-174 MHz., 406-512 MHz., 806-823.995 MHz., 849.0125-868.995 MHz., 894.0125-956.000 MHz.

Our Bearcat TrunkTracker BC245XLT, is the world's first scanner designed to track Motorola Type I, Type II, Hybrid, SMARTNET, PRIVACY PLUS and EDACS® analog trunking systems on any band. Now, follow UHF High Band, UHF 800/900 MHz trunked public safety and public service systems just as if conventional two-way communications were used. Our scanner offers many new benefits such as Multi-Track - Track more than one trunking system at a time and scan conventional and trunked systems at the same time. 300 Channels - Program one frequency into each channel. 12 Bands, 10 Banks - Includes 12 bands, with Aircraft and 800 MHz. 10 banks with 30 channels each are useful for storing similar frequencies to maintain faster scanning cycles or for storing all the frequencies of a trunked system. Smart Scanner - Automatically program your BC245XLT with all the frequencies and trunking talk groups for your local area by accessing the Bearcat national database with your PC. If you do not have a PC simply use an external modem. Turbo Search - Increases the search speed to 300 steps per second when monitoring frequency bands with 5 KHz. steps. 10 Priority Channels - You can assign one priority channel in each bank. Assigning a priority channel allows you to keep track of activity on your most important channels while monitoring other channels for transmissions. Preprogrammed Service (SVC) Search - Allows you to toggle through preprogrammed police, fire/emergency, railroad, aircraft, marine, and weather frequencies. Unique Data Skip - Allows your scanner to skip unwanted data transmissions and reduces unwanted birdies. Memory Backup - If the battery completely discharges or if power is disconnected, the frequencies programmed in your scanner are retained in memory. Manual Channel Access - Go directly to any channel. LCD Back Light - An LCD light remains on for 15 seconds when the back light key is pressed. Autolight - Automatically turns the backlight on when your scanner stops on a transmission. Battery Save - In manual mode, the BC245XLT automatically reduces its power requirements to extend the battery's charge. Attenuator - Reduces the signal strength to help prevent signal overload. The BC245XLT also works as a conventional scanner. Now it's easy to continuously monitor many radio conversations even though the message is switching frequencies. The BC245XLT comes with AC adapter, one rechargeable long life ni-cad battery pack, belt clip, flexible rubber antenna, earphone, RS232C cable, Trunk Tracker frequency guide, owner's manual and one year limited Uniden warranty. Not compatible with AGEIS, ASTRO, ESAS or LTR systems. Hear more action on your radio scanner today. Order on-line at www.usascan.com for quick delivery.

More Radio Products

Save even more on radio scanners when purchased directly from CEI. Your CEI price after instant rebate is listed below:

Bearcat 895XLT 300 ch. Trunktracker I base/mobile scanner.	$179.95
Bearcat 780XLT 500 ch. Trunktracker III base/mobile	$339.95
Bearcat 278CLT 100 ch. AM/FM/SAME WX alert scanner	$159.95
Bearcat 245XLT 300 ch. Trunktracker II handheld scanner	$189.95
Bearcat 248CLT 50 ch. base AM/FM/weather alert scanner	$89.95
Bearcat Sportcat 200 alpha handheld sports scanner	$169.95
Bearcat Sportcat 180B handheld sports scanner	$149.95
Bearcat 80XLT 50 channel handheld scanner	$99.95
Bearcat 60XLT 30 channel handheld scanner	$74.95
Bearcat BCT7 information mobile scanner	$139.95
AOR AR8200 Mark II Wide Band handheld scanner	$539.95
AOR AR16BQ Wide Band scanner with quick charger	$209.95
ICOM ICR8500 wideband communications receiver	$1,469.95
ICOM PCR1000 computer communications receiver	$379.95
ICOM R10 handheld wideband communications receiver	$279.95
Uniden WX100 Weather Alert with S.A.M.E. feature	$49.95

AOR® AR8200 Mark IIB Radio Scanner

AOR8200 Mark IIB-A wideband handheld scanner/**SPECIAL $539.95**

1,000 Channels • 20 banks • 50 Select Scan Channels

PASS channels: 50 per search bank + 50 for VFO search

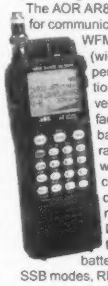
Frequency step programmable in multiples of 50 Hz.

Size: $2^{1/2}$" Wide x $1^{3/8}$" Deep x $6^{1/8}$" High

Frequency Coverage:

500 KHz to 823 995 MHz, 849.0125-868.995 MHz, 894.0125-2,040.000 MHz

(Full coverage receivers available for export and FCC approved users.)



The AOR AR8200 Mark IIB is the ideal handheld radio scanner for communications professionals. It features all mode receive: WFM, NFM, SFM (Super Narrow FM), WAM, AM, NAM (wide, standard, narrow AM), USB, LSB & CW. Super narrow FM plus Wide and Narrow AM in addition to the standard modes. The AR8200 also has a versatile multi-function band scope with save trace facility, twin frequency readout with bar signal meter, battery save feature with battery low legend, separate controls for volume and squelch, arrow four way side rocker with separate main tuning dial, configuarable keypad beep/illumination and LCD contrast, write protect and keypad lock, programmable scan and search including LINK, FREE, DELAY, AUDIO, LEVEL, MODE, computer socket fitted for control, clone and record, Flash-ROM no battery required memory, true carrier re-insertion in SSB modes, RF preselection of mid VHF bands, Detachable MW bar aerial. Tuning steps are programmable in multiples of 50 Hz in all modes, 8.33 KHz airband step correctly supported, Step-adjust, frequency offset, AFC, Noise limited & attenuator, Wide and Narrow AM in addition to the standard modes. For maximum scanning pleasure, you can add one of the following optional slot cards to this scanner: CT8200 CTCSS squelch & search decoder $89.95; EM8200 External 4,000 channel backup memory, 160 search banks. $69.95; RU8200 about 20 seconds chip based recording and playback $69.95; TE8200 256 step tone eliminator $59.95. In addition, two leads are available for use with the option socket. CC8200 PC control lead with CD Rom programming software $109.95; CR8200 tape recording lead $59.95. Includes 4 1,000 mAh AA ni-cad batteries, charger, cigar lead, whip aerial, MW bar antenna, belt hook, strap and one year limited AOR warranty. Enter your order now at http://www.usascan.com.

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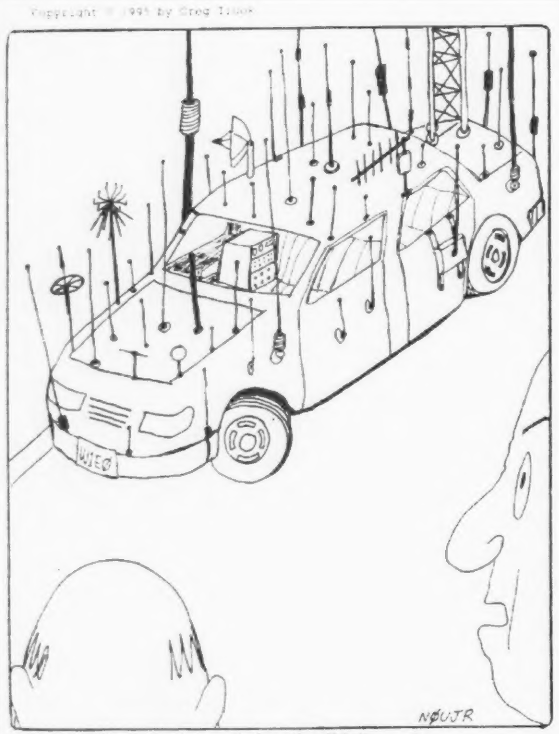
continued from page 1

that the cash-strapped Russians will fly more high-roller space tourists later this year. This could include *Titanic* producer James Cameron, who has already said that he wants to walk in space.

Thanks to Henry Feinberg K2SSQ, via Newsline, *Bill Pasternak WA6ITF, editor.*

New Element 4 Syllabus for Comment

The Question Pool Committee, National Conference of Volunteer Examiner Coordinators, has released the draft syllabus for the new Element 4 Question Pool. This question pool will become effective July 1, 2002. The draft syllabus is available for download at [http://www.arrl.org/arrlvec/pool.html]. The public is invited to comment on this syllabus. All responses must be received prior to August 15, 2001. Please direct your comments to: Scotty Neustadter W4WW, chair, QPC, E-mail [W4WW@arrl.net]; Bart Jahnke W9JJ, member, QPC, E-mail [vec@arrl.org]; and/or Fred Maia W5YI, member, QPC, E-mail [fmaia@prodigy.net].



"...and since Jim's wife didn't want him setting up a station in the house..."

Question Pool Syllabus:
Element 4 - Extra Class

Subelement E1 — Commission's Rules.
[7 Exam Questions —7 Groups]

E1A Operating standards: frequency privileges for Extra class amateurs; emission standards; message forwarding; frequency sharing between ITU regions; FCC modification of station license; 30-meter band sharing; stations aboard ships or aircraft; telemetry; telecommand of an amateur station; authorized telecommand transmissions; definitions of image, pulse and test.

E1B Station restrictions: restrictions on station locations; restricted operation; teacher as control operator; station antenna structures; definition and operation of remote control and automatic control; control link.

E1C Reciprocal operating: reciprocal operating authority; purpose of reciprocal agreement rules; alien control operator privileges; identification. (Note: This includes CEPT and IARP.)

E1D Radio Amateur Civil Emergency Service (RACES): definition; purpose; station registration; station license required; control operator requirements; control operator privileges; frequencies available; limitations on use of RACES frequencies; points of communication for RACES operation; permissible communications.

E1E Amateur Satellite Service: definition; purpose; station license required for space station; frequencies available; telecommand operation: definition; eligibility; telecommand station (definition); space telecommand station; special provisions; telemetry: definition; special provisions; space station: definition; eligibility; special provisions; authorized frequencies (space station); notification requirements; earth operation: definition; eligibility; authorized frequencies (earth station).

E1F Volunteer Examiner Coordinators (VECs): definition; VEC qualifications; VEC agreement; scheduling examinations; coordinating VEs; reimbursement for expenses; accrediting VEs; question pools; Volunteer Examiners (VEs): definition; requirements; accreditation; reimbursement for expenses; VE conduct; preparing an examination; examination elements; definition of code and written elements; preparation responsibility; examination requirements; examination credit; examination procedure; examination administration; temporary operating authority.

E1G Certification of external RF power amplifiers and external RF power amplifier kits; Line A; National Radio Quiet Zone; business communications; definition and operation of spread spectrum; auxiliary station operation.

Subelement E2 — Operating Procedures.
[5 Exam Questions — 5 Groups]

E2A Amateur Satellites: Orbital mechanics; frequencies available for satellite operation; satellite hardware; satellite operations.

E2B Television: fast scan television (FSTV) standards; slow scan television (SSTV) standards; facsimile (fax) communications.

E2C Contest and DX operating; spread-spectrum transmissions; automatic HF forwarding; selecting your operating frequency.

E2D Operating VHF/UHF digital modes: packet clusters; digital bulletin boards; Automatic Position Reporting System (APRS).

E2E Operating HF digital modes

Subelement E3 — Radio Wave Propagation.
[3 Exam Questions —3 Groups]

E3A Earth-Moon-Earth (EME or moonbounce) communications; meteor scatter.

E3B Transequatorial; long path; gray line

E3C Auroral propagation; selective fading; radio-path horizon; take-off angle over flat or sloping terrain; earth effects on propagation.

Subelement E4 — Amateur Radio Practices
[5 Exam Questions — 5 Groups]

E4A Test equipment: spectrum analyzers (interpreting spectrum analyzer displays; transmitter output spectrum); logic probes (indications of high and low states in digital circuits; indications of pulse conditions in digital circuits); PC-based testing procedures and performance limitations.

E4B Frequency measurement devices (i.e., frequency counter, oscilloscope, dip meter); meter performance limitations; oscilloscope performance limitations; frequency counter performance limitations.

E4C Receiver performance characteristics [i.e., phase noise, desensitization, capture effect, intercept point, noise floor, dynamic range (blocking and IMD), image rejection, MDS, signal-to-noise-ratio); intermodulation and cross-modulation interference.

E4D Noise suppression: vehicular system noise; electronic motor noise; static; line noise.

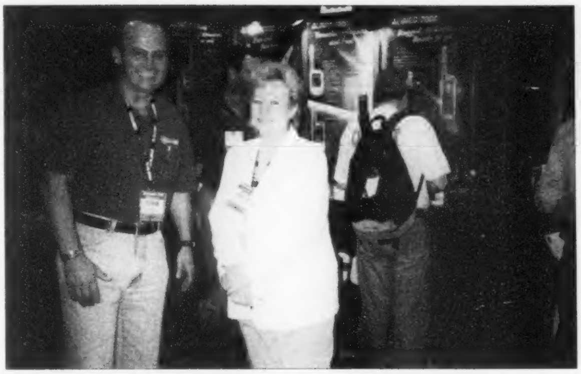
E4E Component mounting techniques [i.e., surface, dead bug (raised), circuit board]; direction finding: techniques and equipment; fox hunting.

Subelement E5 — Electrical Principles
[9 Exam Questions — 9 Groups]

Continued on page 58

DAYTON DAYS

CLOCKWISE FROM RIGHT: *73*'s Evelyn Garrison with new Alinco distributor Craig Cota of Atoc; Les Sullins of D&L Antenna Supply; Linda from Am-Com; staff members of SGC; part of Yaesu's booths; staff members of Universal Radio; and Wayne Dooey and staff members of AEA.



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"No Compromise Communications"

NEVER SAY DIE

continued from page 4

In the forest surrounding the meadow, every inch of ground is the site of constant warfare. Vicious, to-the-death warfare. Only the strongest and most adaptable survive.

When I scuba dive the reefs around the world, I enjoy the beauty of the coral. Yet, if you've watched the PBS shows about the oceans you know that every inch of territory in the ocean capable of supporting life is a battleground — mostly with chemical warfare.

Then there's the food chains, both under water and on land, including ours. More vicious warfare, as the meat-eaters kill the vegetarians and eat them. The songs birds sing are war songs, warning other birds that this is their territory and don't mess with it. Birds eat bugs. Bugs eat bugs. Even ants have wars. Mess with a bee hive and see what happens. That ain't love and peace.

Male animals and birds battle for mates. So do fish. So do men.

Everything live is fighting for life, territory, and reproduction.

Peace? Not if you want to survive.

Submarines

How key were submarines in WWII? Well, with just two percent of all the Navy's personnel, our submarines accounted for more than half of all Japanese shipping destroyed during World War II. Two hundred forty-nine U.S. submarines made Pacific war patrols. Of those, 52 were lost, with a casualty rate of six times that of non-submariners — the highest loss of any branch of the military. Our subs sank 1,392 Japanese vessels.

What was it like on a sub during the war? Read my $5 book, *Submarines in WWII*, for the story of 90% boredom and 10% excitement none of us will ever forget. What's it like to be depth-charged? What's it like when your new-model electric torpedoes are faulty and you almost get sunk as a result? What's it sound like when a ship you've torpedoed is sinking?

JFK and the ETs

Still another who-shot-JFK story arrived via E-mail. I enjoy conspiracy theories, but I don't buy into them without a lot of reliable information to support 'em.

This one has Kennedy, shortly before he was shot, handing Texas governor John Connally the notes for a speech he was going to make. Connally was seriously wounded. Once he read the notes he was terrified for his own life, so he put the notes in a safety deposit box, not to be opened until after his death. He died in 1993 and his aide took them from the box and kept them.

Enter Professor Lawrence Merrick of Cambridge, MA, who got the notes from the aide. The result is a book due out soon, *Killing the Messenger: The Death of JFK*.

His speech was announcing government contact with aliens, saying that they are friendly, not to be concerned, and that details would be released soon. His shooting had to do with keeping this information from the public.

Truth or hoax?

On the other hand, I've also read that JFK had just proposed that the U.S. issue its own currency instead of borrowing it from the Fed and paying interest on it. Since this would cost a very small group of international bankers trillions of dollars, that story also made sense as a reason for JFK's shooting.

There could have been quite a crowd of shooters on that grassy knoll.

Vitamins and Alzheimer's

Just as I've predicted, a Swedish study reported in the *Journal of Neurology* says that nutrition can help prevent Alzheimer's. I haven't seen any reports of studies to see if nutrition can actually reverse Alzheimer's, but I'll be surprised if it can't. The study found that vitamins could prevent Alzheimer's dementia.

I suspect that the reason vitamins and good nutrition make the difference is that they keep the immune system strong enough to keep the brain from turning to mush.

No, Coke does not qualify as good nutrition. Nor do Big Macs. Nor fries.

In another report it was pointed out that 88% of all medications use aluminum hydroxide as a stomach buffer. This, and antacids, are major sources of aluminum.

As I've mentioned before, we also get aluminum from vaccinations and anti-perspirants.

So what's the big deal about aluminum? Excess aluminum in the blood gathers in the brain, interfering with the microvolt brain wiring, slowing down and eventually stopping the circuits from working. Pffft goes short-term memory, and then longer and longer.

My mother, who died of Alzheimer's, could remember her address when she was seven years old in Denver, but couldn't recognize the people she was living with at the nursing home.

I believe that Alzheimer's can be reversed with diet. Please, someone with a sick relative, try out what I recommend in my health guide and let me know how you do.

Women Smokers

As bad as smoking is for men, it's far worse for women, according to a report from the National Institutes for Health. Women are up to twice as likely to suffer strokes, lung cancer, and heart attacks as men smokers. It also can cause birth defects, lower IQ, and low birth weight for their babies. Then there's severe PMS and early menopause. The bottom line is that any young girl these days who takes up cigarettes is either pathetically ignorant, or flat-out stupid. Or both.

Famous Hams

Three hams have recently made the news big time — though their being hams hasn't been mentioned in all the media attention, far's I know.

Number one on our 2001 hall of fame ham list is Dennis Tito KG6FZX who, despite every effort of NASA to prevent it, made a $20 million tourist trip to International Space Station "Alpha." Dennis, who had been a rocket engineer for NASA's Jet Propulsion Lab, wised up and left NASA to start an investment company. Did well, of course.

Number two was Veronica (Roni) Bowers KD4CKM, the Baptist missionary who was shot down by a Peruvian Air Force plane. The story is that the Bowers Cessna float plane was spotted by a CIA surveillance plane, which reported it to the Peruvian military, requesting them not to fire on the Cessna since it did not seem to be carrying drugs.

The third ham in the news is Robert Hanssen K9QVL, the accused spy. Ooops.

More Famous Hams

How many famous hams have you worked? How many do you, or have you known personally. How many have you visited in their homes?

I remember one time I almost worked Arthur Godfrey. He was on a DXpedition to French West Africa at the time and I really wanted to contact him, but I didn't have enough signal to cut it. It wasn't that I was anxious to rack up a new country, or even to have the bragging rights for contacting Godfrey, which probably would have made my Been-There, Done-That list. What was driving me was that with him on the expedition was Colonel Carol Cone, who was a good personal friend from back in 1933.

Col. Cone was a fellow student with my father in 1920 at Kelly Field (San Antonio), and often visited us for dinner when we were living in Washington DC. He and I would play games while my folks cooked dinner. So I was mighty disappointed when I

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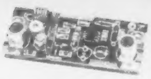
LOW NOISE PREAMPS



LNY-( ) ECONOMY PREAMP **ONLY $29/w&t**

- Miniature MOSFET Preamp.
- Low noise figure.
- *Available* for various bands from 28 to 450 MHz.

LNK-( ) PREAMP
ONLY $59/w&t
Low noise LNY-type preamp in alum case w/ BNC jacks.

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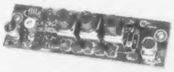
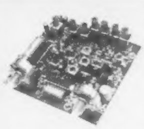


- Eliminate intermod!
- Sharp 3-section filter
- Low noise preamp
- Available for bands from 137 to 170 MHz.

R121 AVIATION RECEIVER



- Exciting new AM receiver for the 118-137 MHz aircraft band.
- Ideal for monitoring at airports.
- Allows pilot control of runway lighting.
- ELT monitor to detect and locate downed aircraft.
- Dip switch frequency selection.
- Superior sensitivity and selectivity.

R121 Receiver module wired/tested **$209**
R121 Receiver in cabinet (see website).................. **$299**

WEATHER FAX RECEIVER

Join the fun. Get striking Images directly from the weather satellites!

A very sensitive wideband fm receiver **optimized for NOAA** APT & Russian Meteor **weather fax** on the 137MHz band.

Covers all 5 satellite channels. Scanner circuit & recorder control allow you to automatically capture signals as satellites pass overhead, even while away from home.

- **R139 Receiver Kit** less case $159
- **R139 Receiver Kit** with case and ac power adapter. $189
- **R139 Receiver w/t** in case with ac power adapter.... $239
- Internal PC demodulator board & imaging software .. $289
- Turnstile Antenna $135

WEATHER ALERT RECEIVER

A sensitive and selective professional grade receiver to monitor critical NOAA weather broadcasts. Good reception even at distances of 70 miles or more with suitable antenna. No comparison with ordinary consumer radios! Automatic mode provides storm watch, alerting you by unmuting receiver and providing an output to trip remote equipment when an alert tone is broadcast. Crystal controlled for accuracy; **all 7 channels** (162.40 to 162.55).

RWX Rcvr kit, PCB only $79
RWX Rcvr kit with cabinet, speaker, & AC adapter $99
RWX Rcvr wired/tested in cabinet with speaker & adapter $139

WWV RECEIVER

Get time & frequency checks without buying multiband hf rcvr. Hear solar activity reports affecting radio propagation. **Very sensitive and selective** crystal controlled superhet, dedicated to listening to WWV on 10 MHz. Performance rivals the most expensive rcvrs.

- **RWWV Rcvr** kit, PCB only $59
- **RWWV Rcvr** kit with cabt, spkr, & 12Vdc adapter $89
- **RWWV Rcvr** w/t in cabt with spkr & adapter $129

HIGH QUALITY VHF & UHF EXCITER & RECEIVER MODULES

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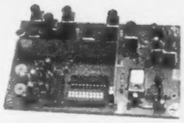


Rated for continuous duty, 2W continuous duty output.

T301 Synthesized VHF Exciter: for various bands 139-174MHz, 216-226 MHz. Dip switch freq. setting.

- Kit (ham bands only) (TCXO option $40)................ **$109**
- Wired/tested, incl TCXO................................ **$189**

T304 Synthesized UHF Exciter: for various bands 400-470 MHz.

- Kit (440-450 ham band only) incl TCXO **$149**
- Wired/tested **$189**

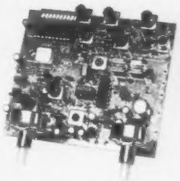
CRYSTAL CONTROLLED:

- **TA51:** for 6M, 2M, 220 MHz .... **kit $99, w/t $169**
- **TA451:** for 420-475 MHz. .... **kit $99, w/t $169**
- **TA901:** for 902-928 MHz, (0.5W out)........ **w/t $169**

VHF & UHF POWER AMPLIFIERS:

Output levels from 10W to 100W....... **Starting at $99**

FM RECEIVERS:



Very sensitive *– 0.2µV.* ***Superb selectivity,*** *>100 dB down at ±12 kHz, best available anywhere, flutter-proof squelch.*

R301 Synthesized VHF Receiver: various bands 139-174MHz, 216-226 MHz.

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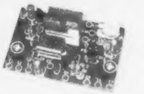

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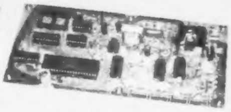

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The Antenna That Never Was

... and the 4S7WHG DXpedition that ALMOST followed suit.

It all started to go wrong when Jan and I arrived at Sri Lanka's Bandaranaike International Airport, about 30 km north of the capital, Colombo, at about 5 a.m. on 9th November last year. Having cleared immigration, we were horrified to discover that the airline had lost two of our three bags — one containing the R-7000 vertical, and the other my clothes, tools, Vibroplex key, MFJ-269, and headphones. Jan's bag arrived safely!

Having spent what seemed like ages filling out a lost baggage report for the airline, we stumbled through the "Green" channel and met up with our English-speaking driver/guide, Karu.

We explained our predicament, and Karu immediately took us to our travel agent's desk in the arrivals area, where I signed a number of forms and handed over my passport and the keys to our missing bags so that the agent could deal with the Customs formalities when the bags did arrive. In anticipation of having the R-7000 with me, which I carry in a six-foot-long ski bag, I had asked for a car with a roof rack. Such things are unknown in Sri Lanka, and we were provided with a six-seater minibus, which was a lot more comfortable than a car, particularly on the long journeys over very poor roads.

Photo A. *G3SWH operating at Milton's Hotel, Unawatuna.*

We then set off on a 3-hour drive to the Kandalama Hotel, near Dambulla, arriving in time for lunch. With a six-hour time shift, a 13-hour flight, and no sleep on the plane, this was now about 7 a.m. body-clock time and we were exhausted.

I had first made contact with Dammika Fernando 4S7DF, the president of the Radio Society of Sri Lanka (RSSL) in October 1999, via the RSSL Web site [www.qsl.net/rssl/], which contains a section on how foreign amateurs can obtain a license to operate from Sri Lanka. Dammika responded very promptly, indicating that he was willing to help with the license application process, which involved submitting copies of numerous documents, including my UK license, a document from the British police stating that I do not have a criminal record, and a copy of the Icom IC-706 technical specifications.

This was all sent off by snail-mail on 11th February 2000, and on 6th July I received an E-mail from Dammika saying that their Ministry of Defense had approved the license application. It was then necessary to snail-mail the document back to the UK for me to sign and return to Dammika, together with the modest fee of 650 rupees (about £6.50), upon receipt of which the Sri Lankan Telecom authorities would allocate the callsign. On 25th September, I received another E-mail from Dammika telling me that I had been allocated 4S7WHG. I had asked for 4S7WH, amongst others, but they always add a "G" for "guest" operators. I asked for him to send it to me by snail-mail, or even a copy by E-mail, but he was strangely reluctant to do so, preferring to meet me on arrival and hand it to me then. This was not practical, given the ungodly hour at which we arrived, so we arranged for Karu to collect it the night before.

Clause (9) of the license states, "The licensed station shall only be operated at the address shown in the license." Dammika had inserted his own address for convenience as, at the time of application, I had no idea where we would be staying. As I was planning to be active from a variety of different locations around the country, he later advised me to append "/A" to my call and to inform the Sri Lankan Telecom authorities by fax of my itinerary, which I did. Unfortunately, I never received any form of acknowledgment or confirmation from them.

We actually booked our trip through Jetwing Travels in Colombo, and Dammika told me of an amateur who worked there. This turned out to be Romesh 4S7RF, who is also GØTAO and the chief executive of Jetwing Hotels. In an exchange of E-mails in mid-October, Romesh mentioned the theoretical need to obtain an "equipment release letter" from the Sri Lankan Telecom authorities to present to Customs on arrival. He told me that this process can take 2–3 months and that most visiting amateurs take their chances with the "Green" channel. He added that there had never been a problem to his knowledge.

As there were only a few weeks before we left UK, obtaining an equipment release letter was not practical. I made various inquiries of the Bristol Chamber of Commerce, the Sri Lankan desk at the DTI, and the UK Customs at Bristol Airport. No one was able to give me any sort of sensible advice as to the best way of documenting such equipment as I would be carrying, so I was left with preparing a list with an official-looking UK Customs stamp on it and following Romesh's advice and taking my chances with the Sri Lankan Customs.

Anyone participating in Sri Lankan traffic seemingly does so with some contempt for life. Basically, the Singalese philosophy on traffic boils down to the idea that every two-lane

Continued on page 12

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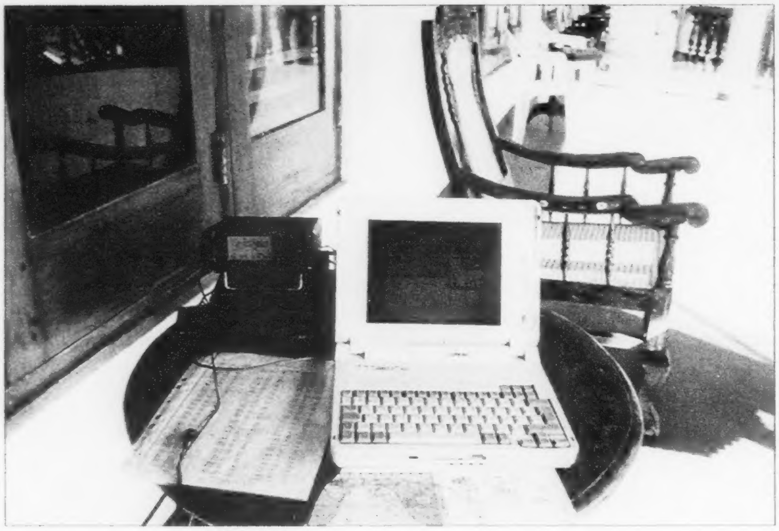

Photo B. The setup at Milton's Hotel.

The Antenna That Never Was

continued from page 11

road is wide enough for three cars, buses, or trucks — all at the same time. This naturally leaves enough space for two bicycles and cows on the loose, not to mention pedestrians. At times, traveling on the island requires some extraordinary driving skills but, in the end, there is always some maneuver you can make to avoid the bus or truck that is coming straight at you, making you realize that you may have just avoided reaching a premature end to your holiday. During the first few days of our stay, driving on these roads caused us to miss an occasional heartbeat, but after that we (more or less) came to accept the situation as part of the experience.

On arrival at the Kandalama, I had literally only the clothes in which I stood up, plus two pairs of underpants, which Jan had carried in her bag. Fortunately, essentials like toothpaste, razor, etc., were also in her bag. A visit to the hotel shop provided two tee-shirts, but nothing like socks or shorts. The hotel is literally in the middle of nowhere, so there was no chance of buying any other emergency clothes. After a wonderful Ayurvedic head massage and an excellent dinner, I washed my socks and we went to bed feeling somewhat numb.

Next morning, we went off to the spectacular rock fortress of Sirigiya. Built in the 5th century on top of a 200-meter-high rock, it's compared by guidebooks to something like a European chateau plonked on top of Ayers Rock. We decided not to climb the precarious staircase to the top and went on to the ancient capital of Polonnaruwa. The ruins here date from the 11th century and include some remarkable Buddhist temples and rock carvings. It started to rain whilst we were there and, due to the necessity to remove one's shoes when visiting Buddhist temples, much of the visit was conducted with wet feet.

On the way back to Kandalama, my mind started to work, and I began to think of what could be achieved radio-wise with the equipment I had on hand. I carry the Icom IC-706, power supply, laptop, wire antennas, coax, and various odds and ends in my hand luggage, so I had the basis of a station. Keying the transmitter was possible using the laptop's keyboard and CT, but I was missing a pair of headphones. Jan came to the rescue with a pair of simple ear pieces from her portable CD player. I was in business!

The Kandalama hotel is an architectural gem, built into the side of a mountain, facing north, and overlooking a 1st century manmade lake called a tank. The exterior of the 1-km-long building is covered in carefully cultivated vegetation to hide the concrete outline. Our room was on the third floor, with a convenient tree in the garden below, so a sloping dipole was practical and the takeoff looked good. I already had permission from the hotel manager to operate, so I set about rigging the antenna. This proved much more difficult than expected, mainly due to the nylon string tangling in the vegetation, and I had to abandon my efforts when dusk fell.

We left next morning for a three-night stay in Kandy, the ancient capital of the country, so I was hopeful of some activity from the Citadel Hotel. When we arrived, there was a message

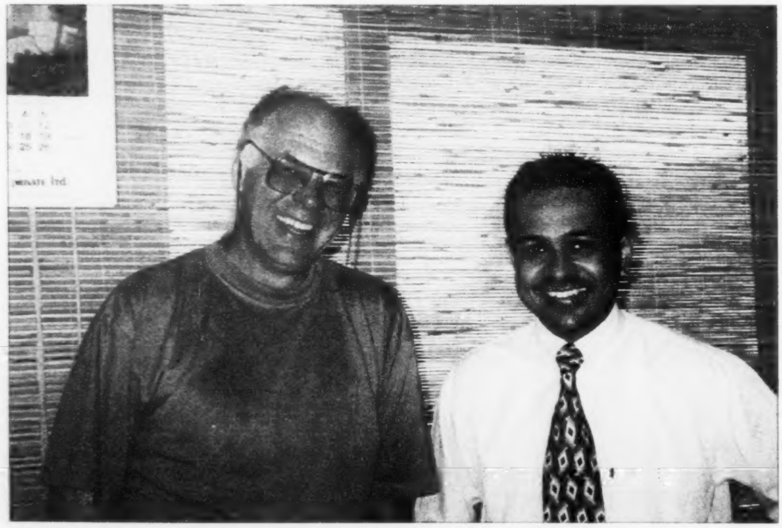

Photo C. Left to right, Phil G3SWH and Romesh 4S7RF.

from the airport saying that they had received my bags, which had been left in Amsterdam, but that the Customs would not release the antenna or other items without a copy of my license, so could I please fax them a copy. The good news was that the bag containing my clothes was en route from Colombo. The hotel's fax machine failed to co-operate, but I was fortunate to be able to send the copy document back with the driver who delivered my clothes.

Again, I had permission to operate from the hotel management and made contact with the chief engineer almost as soon as we arrived. He could not have been more helpful, even arranging one of his electricians to scramble over the hotel roof to help rig the antenna — much to the alarm of some of the other guests!

There was no opportunity to operate that day, as we went off to see the Temple of the Tooth and a typical Sri Lankan cultural show. Later that evening, the hotel laid on some live music, which was very loud in our room, resulting in a late night change to a quieter room on the ground floor. The antenna thus had to be taken down again very early the next morning before we set off for the day's visit to the Pinewella Elephant Orphanage at Kegalle. The highlight of the morning was to see about 50 elephants of all sizes being driven down the village street to bathe in the shallow river.

The antenna I rigged at the Citadel was a simple wire dipole for 20, 30, or 40 meters, adjusted by means of crocodile clips and supported by a length of nylon string. I have successfully used this particular antenna in Tanzania and on Reunion, and lastly on the Wasini Island expedition in Kenya. I was rather taken aback to see that the 20 meter section had been folded back on itself, presumably to resonate on 17 meters during the visit to Wasini Island. The new room was not so well situated for a horizontal antenna, but a sloping dipole from a tree was possible. The assumed 17-meter dipole didn't resonate on 17 meters, or on any other amateur band, but I did manage to tune it by means of an ATU. After a few unanswered CQ calls on 18073 kHz, I moved up the band and found Kjell SM0CCE just finishing a QSO with another 4S7 station. I called him and he came straight back and gave me 549 — my first QSO at 11:08 UTC on 13th November! After a short chat, Kjell kindly left me with the frequency. I had about 40 QSOs, mainly with eastern Europe, but including G3JZI over the next hour or so, but I was obviously not getting out as well as I would have liked.

We then moved on to Nuwara Eliya in the hill country for one night. Even though I had permission to operate at the Galway Forest Lodge, overhead power lines surround the building and we were scheduled to leave at dawn the following morning, so amateur radio was not on the agenda for that day. There was a fax from Jetwing to say that the Customs would not release the antenna to them as they required some more documentation. I spoke to Dammika 4S7DF by telephone, who told me not to worry, as a friend of his was the chief Customs Officer at the airport and he would try to arrange the release of the equipment on my behalf. I asked him to arrange to forward it to our last hotel at Unawatuna, where we were to spend five nights relaxing after a fairly grueling tour.

We then moved on for two nights at the Yala Safari Beach Hotel, close to the entrance to the Yala West National Park on the southeastern coast. What a superb hotel! We arrived in the late afternoon after a long journey via Horton Plains, where we made a 10 km trek to see World's End, an awesome 700-meter precipice with magnificent views. Our room faced onto the beach and was about 150 meters from the sea itself. There were two lines of stunted trees, between which I rigged a horizontal dipole running east/west. By this time, I had calculated the length of a 20-meter dipole, and adjusted the so-called 17-meter dipole to this band. Without an ATU, the SWR was 1.3:1; the first QSO was with R1ANZ at 12:40 UTC, just about dusk, on 15th November. The choice of 20 meters proved to be a bad one, as activity was almost nonexistent at the times when I

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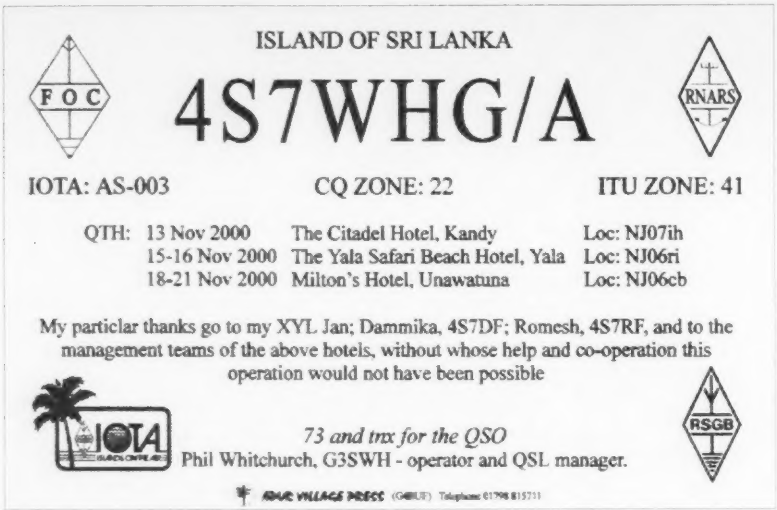
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IOTA: AS-003 CQ ZONE: 22 ITU ZONE: 41

QTH: 13 Nov 2000 The Citadel Hotel, Kandy Loc: NJ07ih
15-16 Nov 2000 The Yala Safari Beach Hotel, Yala Loc: NJ06ri
18-21 Nov 2000 Milton's Hotel, Unawatuna Loc: NJ06cb

My particular thanks go to my XYL Jan; Dammika, 4S7DF; Romesh, 4S7RF, and to the management teams of the above hotels, without whose help and co-operation this operation would not have been possible

73 and tnx for the QSO
Phil Whitchurch, G3SWH - operator and QSL manager.

Photo D. *The QSL card.*

was active. A short session before dawn (about 23:00 UTC) the next day produced QSOs with several Caribbean stations, Canada, and the eastern seaboard of the USA, but only 15 QSOs in total.

One of our principal interests on our travels is birdwatching, and we were well rewarded in the Yala area with painted storks, blue swamp hens, and three species of bee-eaters, as well as elephant, buffalo, and wild boar. The hotel does not have a swimming pool, which was probably just as well, as there were several crocodiles in the adjacent lagoon who would probably have taken up residence. The morning we left, it was raining and I was up before dawn, running around the beach in swimming trunks with a torch between my teeth, taking down the antenna.

We were looking forward to spending a few days relaxing at the Unawatuna Beach Hotel, near Galle on the southwestern coast. This hotel was our choice, rather than a recommendation from Jetwing, and it very quickly proved to have been a mistake. Our room was on the third floor overlooking the garden and was really quite comfortable, except that it stank of paint. We had expected a much larger property, with some space for antennas. As it turned out, it was extremely overcrowded and noisy. The last straw was a disco during the first evening, the noise from which was inescapable. Jan was in hysterics by 10 p.m. When I complained, the duty manager cheerfully told me it would be over by 12:30 a.m.! There were no alternative, quieter rooms available, and we moved out the following morning.

With Jetwing's agreement and the help of a local tuk-tuk (three-wheeled taxi) driver, we found and moved into a smaller hotel called Milton's, about 0.5 km away, which was much more suited to us. Telephone calls to Jetwing revealed that the Customs would still not release the antenna, and they recommended I go to Colombo to try to sort it out myself. I reluctantly agreed to travel earlier than planned on our last day, with a view to negotiating its release so as to be able to take it home with me on the outgoing aircraft.

With the hotel owner's permission, I set up a sloping dipole for 12 meters in a tree on the edge of the Indian Ocean. This was facing southwest, which was not the best direction for Europe, but I managed to generate a respectable pile-up between mid-afternoon and dusk on Saturday, 18th November. My signal was obviously not very strong, and G3HTA gave me 229. He was a comfortable 579 himself. When the band died, I'd made 214 QSOs. I was hoping for a repeat performance on Sunday 19th, but there was a tremendous electrical storm that afternoon which not only made operating slightly dangerous, but also was accompanied by torrential rain that reduced visibility to about 50 meters for several hours. The centerpiece of the dipole filled up with water and had to be dried out the next day when the rain had stopped.

Sessions on the afternoons of the 20th and 21st produced 174 and 134 QSOs respectively. I tried extending the dipole to work on 15 meters and 17 meters, but was obviously not getting out so well as on 12 meters when the band was open. Fluctuations in the electricity supply voltage sometimes meant that there was not enough voltage to operate the interface between the computer and the radio, which was most frustrating and led to reports of QSD.

Photo E. *The Kandulama Hotel, near Dambulla.*

We traveled back to Colombo on the morning of 22nd November and were taken to the airport to meet the Customs officials. Bandaranaike Airport is subject to very strict security precautions. One guidebook says it's probably one of the most secure airports in the world. It's certainly bristling with armed troops and machine gun nests! After much delicate negotiation, I was able to persuade the Customs to allow me to collect the antenna, etc., on production of my boarding card. They took some convincing that I needed to check the antenna as hold baggage, i.e., before I was given my boarding card, but eventually agreed for me to call back at 2 a.m. the next day. When I was checking in the rest of our bags, they would release the equipment. Under no circumstances would they even consider releasing the goods to me that afternoon! So much for Romesh's claim of there never having been a problem with the Customs! However, I remain convinced there would have been no problem at all if the airline hadn't lost the bags.

At 2 a.m. I duly reported to the Customs officer in the departures hall. Check-in desks at Bandaranaike International Airport open promptly three hours before departure time, so we had to hang around for another 45 minutes before we could even think about checking in. Once through the security check, I was whisked off to the arrivals area and produced my authority to collect the equipment. After much further deliberation and form filling, I was allowed into the store to identify the bags. The ski bag was immediately obvious, but the two boxes containing the MFJ, Vibroplex, etc., had been put into a large plastic bag and both secured with wire seals. There was a further difficulty when I tried to take both parcels, as the Customs paperwork only related to one parcel! After much further negotiation and the payment of a 500 rupee "storage charge" (about £5), I managed to extricate myself and the two bags to the departures area and check them in.

The flight home left at 06:45 local time and called at Male in the Maldives and Abu Dhabi in the UAE before arriving at Amsterdam at 17:20 local the same day. There was a short delay before our flight to Bristol, which arrived at 20:25 local. To crown it all, our very carefully arranged lift home got the day wrong and we had to take a taxi from the airport. Once we got home, we had been traveling for 26 hours, and were again exhausted and in need of a holiday to recover. We were waking up at 4 a.m. every day for the following week!

I made a total of 584 CW QSOs with 63 DXCC entities, 507 of which were on 12 meters, which was nowhere near the level of activity that I had planned. Once again, I have proven to myself (if to no one else) the need to have a simple but flexible antenna system where band changes can be easily made to suit the prevailing propagation.

Chris Page G4BUE at the Adur Village Press pulled out all the stops and both printed and despatched the QSL cards within 24 hours of receiving the fax of my very rough design. The first direct cards were sent out within a week of returning home. QSLs are available from either my *Callbook* address with return postage and SAE or via the RSGB bureau.

My particular thanks go to my XYL Jan; Dammika 4S7DF; and Romesh 4S7RF/G0TAO; and to the management teams of the Citadel Hotel (Kandy), the Yala Safari Beach Hotel (Yala), and Milton's Hotel (Unawatuna), without whose help and cooperation this operation would not have been possible.

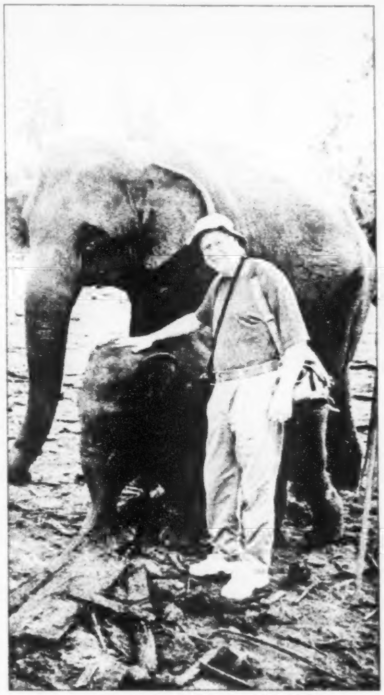

Photo F. Phil with a new friend, at the Pinewella elephant orphanage.

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Power Supplies Explained

The esoteric facts.

In some places, power supplies are called power conditioners, and power supplies are reserved for the AC mains, generators, or batteries. I'll call those things that change the AC mains to DC, power supplies.

The process of converting AC voltage to DC requires rectifiers to change the AC to pulsating DC which must then be filtered or smoothed to a more or less constant value. The filtering can be complex or as simple as just a capacitor. The current to be provided usually dictates the kind of filtering that is used. The voltage may have subsequent regulation depending on the needs of the circuits to be powered.

Rectification is usually accomplished with silicon diodes. Aside from their small size and long life expectancy, semiconductors are preferred because of their low forward voltage drops. Low forward voltage drops leads to increased efficiency and lower transformer volt amp ratings. In the '50s, selenium stacks were used for rectification, and before that vacuum tubes, either diodes or mercury vapor, were used. Silicon rectifiers have voltage drops in the order of a volt or less, compared to the fifty volts or so with tubes. It's easy to see why tube rectifiers are seen only in old equipment. If you modify some old gear by swapping tubes for semiconductors, be sure to allow for the increased output voltage that will occur with semiconductors. Of course, you can add resistance in series with the diodes to provide the extra voltage drop that existed in the tubes.

A transformer is usually used to change the input AC to the level needed. The transformer is rated in terms of volt amps (VAs) instead of watts. The physical size of the transformer is directly related to VAs: small VA, small size. There is some latitude in the relationship, but a small transformer delivering high VAs will operate with a high temperature and have poor regulation. That is, the secondary voltage will drop under load. For example, a transformer may be rated at 25 volts at 2 amps, but unloaded or lightly loaded, the transformer's output voltage may be 28 or 30 volts. You can live with that if you accept the fact that the output voltage will vary with load.

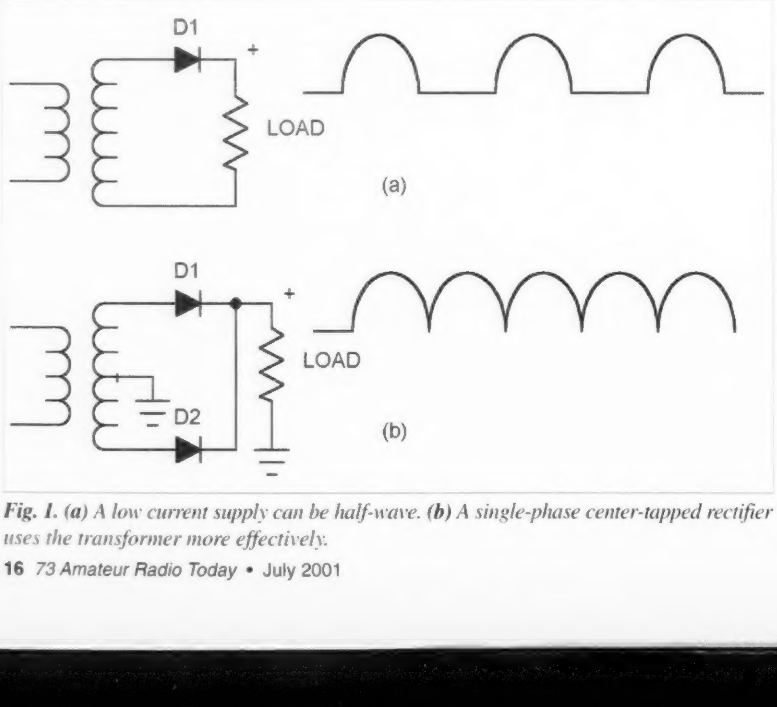

*Fig. 1. (**a**) A low current supply can be half-wave. (**b**) A single-phase center-tapped rectifier uses the transformer more effectively.*

Some transformers that are wound on special cores like Hypersil, a Westinghouse trademark, can reduce the size a little bit, but they are more expensive. The transformer can be a tapewound toroid, but it will be even more expensive for a given VA. There are no real standard transformers, but voltages of 6.3 V, 10 V, 12.6 V, 18 V, 24 V, and 25.2 V are fairly common with a range of secondary currents.

Rectification of the output of the transformer comes in two forms: half-wave and full-wave. Half-wave rectifiers [see **Fig. 1(a)**] conduct only for a half-cycle and consequently produce DC current in the transformer secondary. The DC current can lead to saturation of the core, which results in reduced output voltage and heating in the primary. For light loads, the transformers probably have enough iron in the core so they won't saturate. Still, it's a poor use of the core's VA capability, and full-wave rectification is usually used.

Full-wave rectification, shown in **Fig. 1(b)**, conducts on both halves of the cycle; D1 conducts on one half of the cycle and D2 conducts on the other half. The DC current in each half of the centertapped secondary produces opposing magnetization and doesn't saturate the core. Full-wave rectification can be accomplished with two diodes and a transformer with a centertapped secondary or with a single secondary transformer with four diodes in a full-wave bridge as shown in **Fig. 2(a)**. Since two diodes of the bridge are in series, the bridge has a higher forward voltage drop. An untapped secondary also means the transformer can be marginally smaller and cheaper for a given VA because a single secondary is smaller and cheaper to wind than two.

The bridge arrangement is commonly used for higher currents or when only a transformer with an untapped secondary is available.

A three-phase transformer is almost always used with a bridge rectifier as shown in **Fig. 2(b)**. Three-phase transformers are usually wound with a delta connected primary to ensure balance on the lines. The secondary can be connected either as a wye or delta. The phase relationship of the wye and delta are 60°. The secondaries of the wye have a common terminal, the neutral. If the line-to-line voltage of the delta is 208 V, the line-to-neutral voltage of the wye is 120 V. Unfortunately, three-phase power is not commonly available to residential customers and we have to settle for single-phase power. 220 volts single phase is usually available and a 20 A branch can easily supply the power for a kilowatt station.

The semiconductors have a forward voltage drop given as V_f for some specified current. The forward drop of the rectifiers subtracts from the voltage of the transformer. This effect on the output is small, effectively reducing the transformer's secondary voltage by a volt or so. This difference is usually ignored unless the secondary voltage is very low and you're working with a tight voltage budget. When the forward voltage drop of silicon rectifiers is too great, a change to Schottky diodes may be in order because they have a forward drop that is about half that of a silicon rectifier such as the 1N4001.

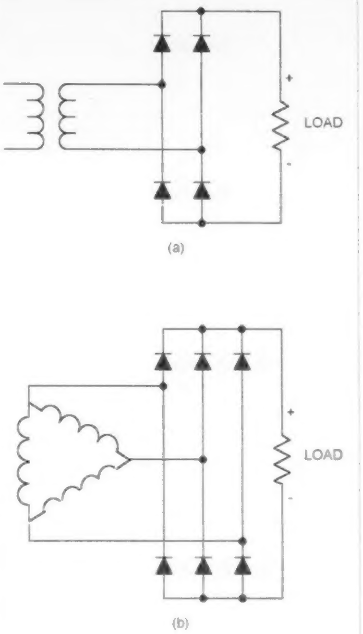

Fig. 2. ***(a)*** *A full-wave bridge uses a single secondary.* ***(b)*** *A three-phase system uses a bridge.*

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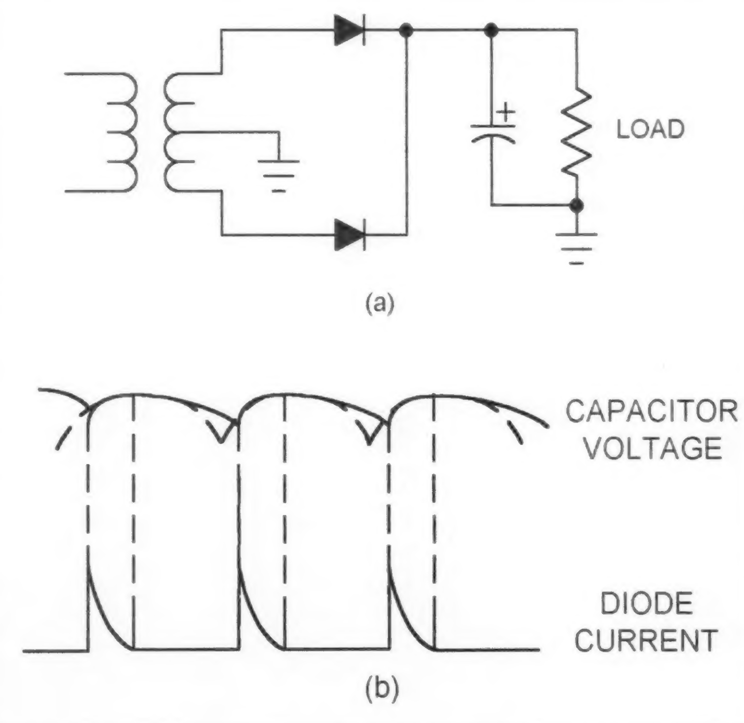


Fig. 3. ***(a)*** *A full-wave rectifier can have a capacitor filter.* ***(b)*** *The rectifier current flows in short pulses.*

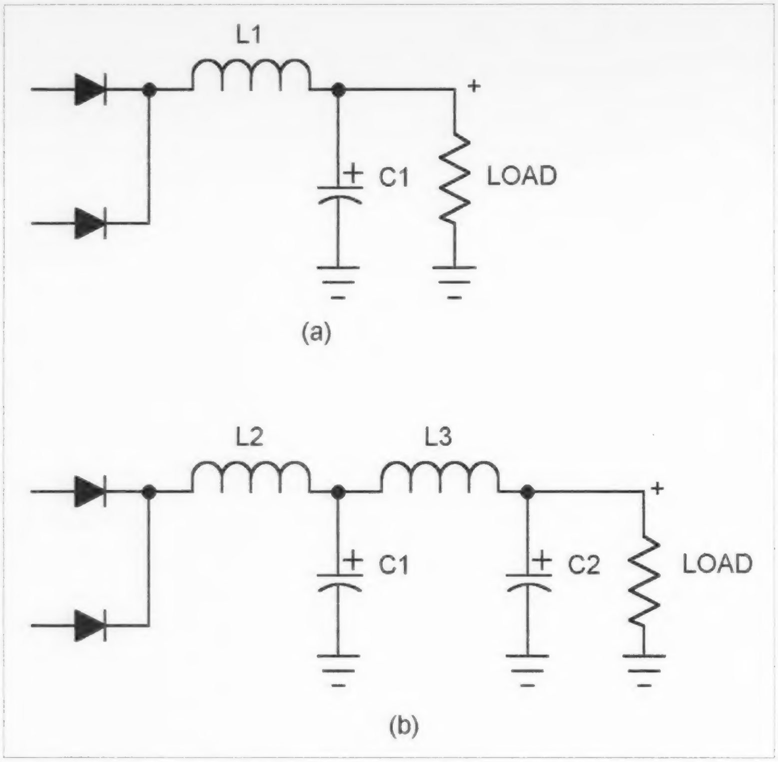


Fig. 4. ***(a)*** *A choke input filter is used with higher currents.* ***(b)*** *A multisection filter further reduces ripple.*

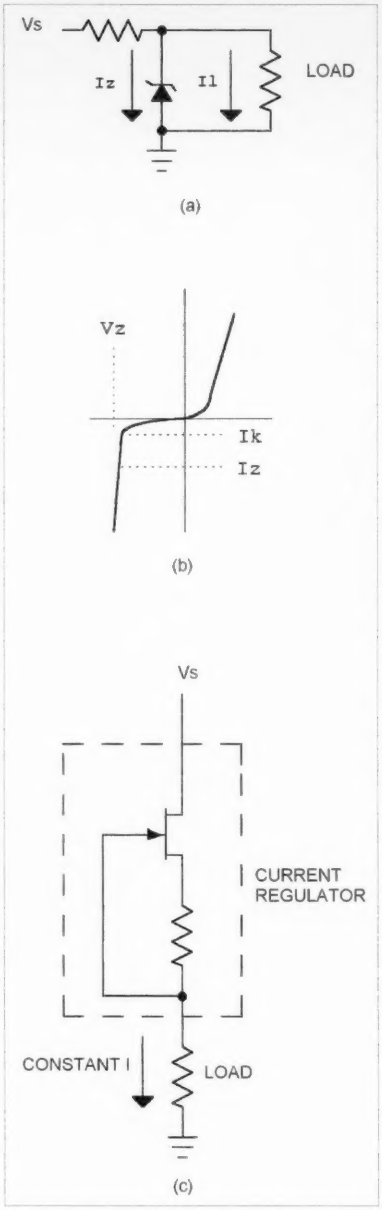


Fig. 5. ***(a)*** *A zener diode is a shunt voltage regulator.* ***(b)*** *Zener diode's forward conduction is similar to an ordinary silicon diode's.* ***(c)*** *A field effect transistor can be used as a current regulator.*

For example, the rectified voltage from a 12 V transformer is about 16 Vpk even though the transformer's peak voltage is 17. With a full-wave bridge rectifier, shown in **Fig. 2(a),** there are two diodes in series and the output will be about 15 volts.

The unfiltered ripple voltage at the output of a full-wave rectifier, the RMS of the ripple voltage to the DC voltage (the average voltage), will be 48%, but that is not a necessarily useful figure. In many applications the peak-to-peak ripple after filtering is the important value.

The RMS ripple for a three-phase bridge is 4.2% of the DC voltage, and the ripple frequency is six times the line frequency, while the ripple frequency for a single-phase full-wave rectifier is twice the line frequency. The advantages of a three-phase power supply are apparent: high ripple frequency for easy filtering and high current. Unfortunately, three-phase power is not common for residential customers, so the discussion of three-phase power supplies is only mentioned in passing.

The filter for the pulsating DC from the rectifier can take several forms, the choice being determined by the current levels. For example, a low current supply will probably have a simple capacitor filter. The capacitive filter is shown in **Fig. 3(a)**. The waveforms and currents are shown in **Fig. 3(b)**. The rectifiers charge the capacitor to the peak of the pulsating DC, and the capacitor is discharged by the load current. For example, a full-wave rectifier will replenish the charge every half cycle or every 8.3 milliseconds for 60 Hz mains. The voltage on the capacitor can be expressed as $dV/dt = I/C$, where dV is the change in voltage; dt is the time of charge or discharge in seconds; I is the current in amperes; and C is the capacitance in Farads.

Rewriting the equation for 60 Hz mains, $dV = I \times 8.3^{-3}/C$.

When C is 1000 µF and I is 0.1 A, the peak-to-peak ripple will be 0.83 volts.

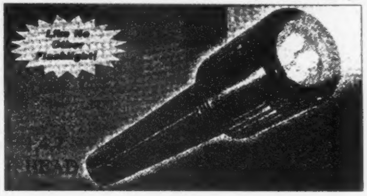
A capacitive filter takes current from the rectifiers for that time when the output of the rectifiers is greater than the voltage on the capacitor. When the ripple voltage is low, the conduction time is short and the ratio of peak-to-average rectifier currents is high. For low currents this can be tolerated, but when the currents are high, rather large diodes are needed and the transformer must tolerate the high peak/average ratio. The result is poor utilization of the transformer's VA capability.

The peak inverse voltage (PIV) rating of the diodes is influenced by the voltage on the filter's input capacitor. When the voltage on the capacitor is equal to the peak pulsating DC voltage, the PIV is equal to twice the secondary voltage. For example, if the voltage on the capacitor is, say, +15 volts on the positive half-cycle, the peak voltage on the negative half-cycle will be –15 volts and the inverse voltage across the diode will be 30 volts.

A choke input filter as shown in **Fig. 4** is usually used for high currents. The input choke prevents the capacitor from charging to the peak, and when the choke is greater than a critical value, the current flow is continuous. The critical inductance is $R_{load}/1000$ Henrys. With an inductor greater than the critical value, the peak-to-average current ratio is about one, and the current rating of the diodes and the transformer is about equal to the load current. Finding a choke with the critical inductance will be a piece of luck, but any choke with more than the critical value is fine. The ripple at the output of a choke input filter can be expressed as $E_{ripple} \approx E_{DC} \times 0.83/LC$, where E_{ripple} is the RMS ripple voltage and L is in Henrys and C is in Farads. The inductor is assumed to be greater than the critical value.

A multisection filter is often used when the ripple must be low. A two-section filter, common in tube type applications, is shown in **Fig. 4(b)**. The first section can employ a relatively small choke whose reactance varies with current, a swinging choke. A swinging choke uses less iron in the core and operates near saturation. At high current, the choke operates near saturation and the inductance is relatively low, but at low currents the operation is below saturation and the inductance increases. A second filter section can be used to reduce the ripple voltage. It reduces the ripple by approximately $1/[(2\pi 60)^2 L_2 C_2]$. In many applications, a regulator follows the filter to stabilize the voltage and further reduce the ripple. A typical regulator IC reduces the ripple by as much as 50 dB.

Regulators can be either series or



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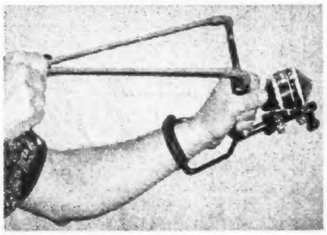

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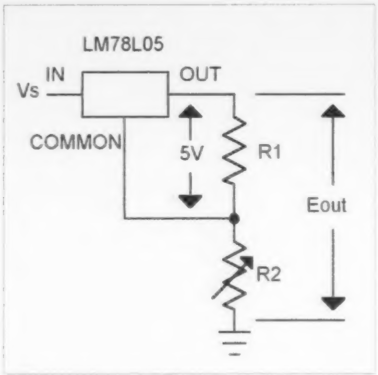

Fig. 6. A fixed three-terminal regulator can have a variable output voltage.

shunt. A zener diode shunt regulator as shown in **Fig. 5(a)** is equivalent to the VR tube of days gone by. The zener diode's characteristics are shown in **Fig. 5(b)**. When the voltage exceeds the zener knee, the diode breaks down and becomes a low resistance. The breakdown resistance is low and the voltage almost constant. The resistance in series with the diode limits the sum of the current in the load and the diode. As the load current decreases, the diode's current increases. The source voltage is $V_Z + Rx(I_Z + I_{load})$. For good regulation, the series resistance should be high compared to the breakdown resistance. At the knee, just at breakdown, the diode generates considerable noise and the breakdown resistance is rather high. Therefore, the diode current should be greater than the current at the knee. Zener voltages are available from 1.8 volts to 200 volts in approximately 10% steps, with power ratings from 0.25 watts to 50 watts.

Special-purpose field-effect current regulators are shown in **Fig. 5(c)**. Regulators for currents from 0.22 mA to 4.7 mA are available from Motorola. The regulators produce a constant current for supply voltages up to 100 volts.

While shunt regulators are simple, series regulators are very common for higher current. For example, the LM78LXX and LM79LXX are positive and negative three-terminal regulators in a TO-92 package. These regulators maintain a constant output voltage from 5V to 15 V for inputs of about 30 volts. The only requirement for the input voltage is that it be more than 2.5 volts above the regulated output voltage. These regulators can regulate about 250 mA when the case temperature is held to 25° C. But, that's an unlikely condition.

Thermal problems are probably the most bothersome ones to be faced in designing a power supply, or any high-power circuit for that matter, because the thermal constants of the semiconductors are not always given in the data sheets. While the maximum operating temperature is always given, the thermal resistance or derating factors are not. Fortunately, all packages of a similar type have similar thermal resistance. For example, the TO-92 small plastic package has a junction to case thermal resistance $R_{\theta JC}$ of about 83° C/W and a junction to ambient of something in the range of 200° C/W, the large TO-3 metal case typically has an $R_{\theta JC}$ of about 2° C/W, and the TO-220 has an $R_{\theta JC}$ of about 5° C/W. These resistances aren't exact, of course, but they are in the ballpark. The maximum junction temperature is usually 150° C or 200° C. In the absence of better information, these estimates can keep your transistors from becoming toast, at least until you can determine how hot they are.

From these estimates of thermal resistance and the rated power dissipation, you can calculate the maximum thermal resistance from the junction to the ambient (air), $R_{\theta JC}$ to $R_{\theta JA}$. For example, if the maximum operating temperature is 150° C and the power dissipated is 1 W, then $R_{\theta JC} + R_{\theta CS} + R_{\theta SA}$ must be less than 150° C/W. If $R_{\theta JC}$ is 83° C/W, and the thermal resistance case-to-sink $R_{\theta CS}$ is 1° C/W, then $R_{\theta SA}$ must be less than 65.7° C/W.

If the maximum operating temperature is 150° and the device is dissipating 1.5 W, there must be less than 150°/1.5 W (100° C/W) of thermal resistance between the junction and the ambient. With a TO-92 package with $R_{\theta JC}$ of 83° C/W then between the junction and the ambient, the heat sink must offer less $R_{\theta SA}$ than 17° C/W to keep the junction less than 150°.

The thermal resistance of the heat sink $R_{\theta SA}$ is strictly a function of heat sink size, and construction. Big heat sinks have lower $R_{\theta JA}$ than small ones, and copper is slightly lower than aluminum. Of course, cool air moving over any heat sink lowers the $R_{\theta JA}$ even more, and the more air, the lower the $R_{\theta JA}$. The cross-section of the sink at the transistor determines how quickly the heat is carried away. A large heat sink like the foil on a circuit board can be cool at the edges but hot at the transistor. A little more mass is required to keep the transistor from frying.

A smooth interface between the case and the heat sink is very important, as is the thickness of thermal grease smeared between the case and heat sink. More grease isn't better, either. The lowest case-to-sink resistance $R_{\theta CS}$

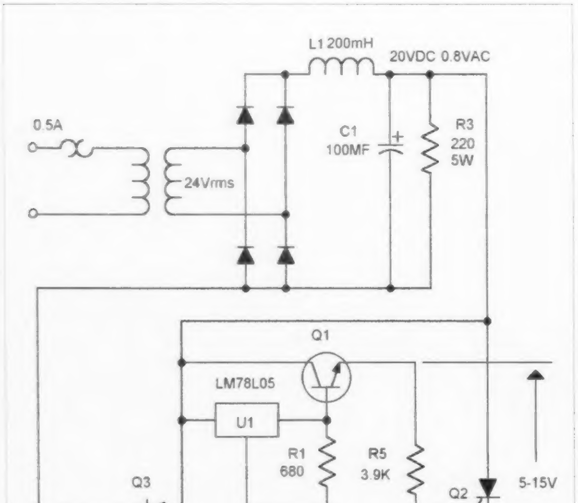

Fig. 7. A variable supply can be simple.

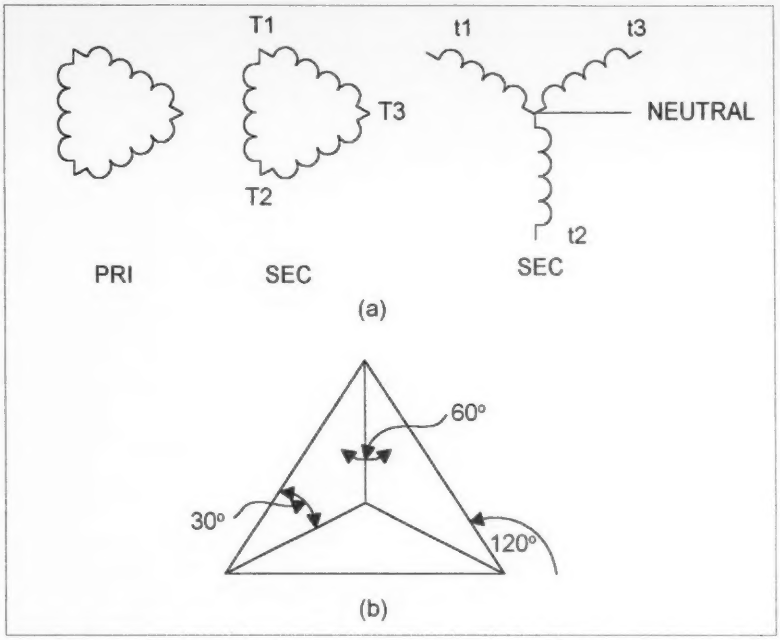

*Fig. 8. **(a)** A three-phase transformer can have either wye or delta secondaries. **(b)** The wye and delta phases are 30° apart.*

is obtained when the grease is barely visible.

The output voltage of a three-terminal 5- volt regulator like the LM78L05 can be increased by floating the common terminal on a constant voltage. **Fig. 6** shows how the output voltage can be varied. The voltage across R1 is a constant 5 volts; therefore, the current in R1 is also constant at 5/R1. This constant current flowing in the resistance R2 raises the common terminal of the 78L05 to 5 x R2/R1 volts. The current in R2 is the sum of the current in R1 and the quiescent current of the regulator. The quiescent current of the LM78LXX varies from about 5 mA to 4 mA as the case temperature approaches 50° C. Without R1 and only R2 in the common terminal, the voltage at the common terminal could be raised to the required value, but the regulated voltage would be temperature-sensitive. It's better to have a regulated current as a significant part of the total current in R2. The output of the regulator is then the sum of the voltages across R1 and R2.

A higher-current regulated supply can be made by applying the output of the LM78LXX to the base of a power transistor as shown in **Fig. 7.** The regulation won't be quite as good as with the LM78L05 because the emitter follower can't have unity gain, and the emitter won't exactly follow the base, but it's close.

A simple variable 5- to 15-volt supply capable of about 2 A is shown in **Fig. 7**. The transformer secondary voltage is 24 volts RMS. The input filter inductor

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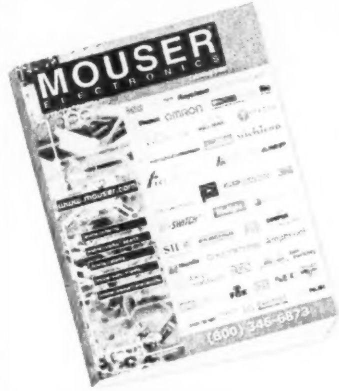

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should be larger than the critical value at the lightest load. Therefore, a 200 Ω 5 W bleeder resistance on the filter is used to establish the minimum load. The critical inductance then is 200 mH.

The LC product of the filter must exceed a certain minimum to ensure a required ripple factor. The ripple factor for single-phase full-wave input is $r = 0.83/LC$, where L is in Henrys and C is in μF.

When L is 200 mH and C is 100 μF with 50 WVDC, $r = 0.0415$. When the unfiltered ripple is 48%, the resulting ripple is about 2% or 0.83 V.

The output of U1, the LM78L05, in **Fig. 7** cannot be greater than about 16 volts if U1 is to remain in regulation. The output of U1 can be made variable as described earlier (see **Fig. 6**). When R1 is about 680 Ω, the current in it will be about 7 mA and the current in R2 will be about 12 mA. When R2 is 1k, the output voltage will be about 17 V.

The h_{FE} of the 2N6594 Q1 is typically 90 when the collector current is 2 A and requires about 22 mA of base current to be supplied by U1. The current supplied by U1 is base current plus 7 mA for R1. When the output is 5 V and the input is 20 V, the power dissipation in U1 will be 15 V x 0.029 A, or 0.3 W. With the junction-to-case thermal resistance $R_{\theta JC}$ for a TO-92 package about 83° C/W, a small heat sink with a $R_{\theta SA}$ of about 122° C/W is required to keep the temperature below 125°.

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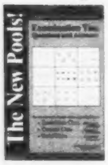

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The power dissipated in Q1 is also greatest when the output voltage is minimum. The maximum dissipation is about 30 W when the output is 5 V and the current is near 2 A. The 2N6594 transistor is rated at 100 W when the case temperature is at 25° C and has zero dissipation at 200° C. The thermal resistance junction-to-case, $R_{\theta JC}$, is 1.75° C/W (175°/100 W). When the junction temperature is 200° C and dissipation is 30 W, the thermal resistance junction-to-ambient must be less than 6.67° C/W (200° C/30 W). Since $R_{\theta JC}$ is 1.75° C/W, the thermal resistance from case to ambient must be less than 5° C/W. With 30 W of dissipation, the heat sink will be about 122° F. That won't raise a blister, but it's uncomfortably hot.

Using an LM79L05 and a 2N6594 will make a variable negative supply from a –20 volt unregulated supply.

For those who need high power and have three-phase power available, a delta delta wye transformer with the primary and one secondary connected delta and the other secondary connected wye provides the opportunity to have a very low ripple supply with minimal filtering. The line-to-neutral are displaced 30° from the line-to-line voltages. **Fig. 8** shows the phase diagram of wye and delta. Taking the delta connection as the reference of one, the line-to-neutral of the wye has a value of 0.57735. A 208 V delta produces 120 V when connected as a wye. Since the delta and wye have a 30° relationship, full-wave rectification produces a ripple frequency that is 12 times the line frequency, with a ripple of about 2%.

The matter of protection of the supply and load should not be ignored. A fuse or circuit breaker in the primary of the power transformer may protect against overcurrent, but even a fast-acting fuse may not be fast enough to protect transistors that are in the load. Fuses and circuit breakers certainly aren't variable. However, a solution is at hand.

A small SCR like the 2N5060 can provide variable overcurrent protection. Q3 in **Fig. 7** triggers when the voltage at the gate exceeds 0.6 V and effectively shorts the output of the filter. The main circuit breaker opens after a fraction of a second. The current in the SCR will be high until the breaker opens, but the effect is a transient that the SCR can tolerate. Of course, a fast-acting breaker is desired that opens with 0.5 A. A large safety factor in the current rating is not required, because the in-rush current is limited by the filter's inductor. The value of the rheostat R7 in the gate of Q3 should be $0.6/I_{trip}$; a 25-ohm resistance will trigger the SCR with 24 mA, while a resistance of 0.3 ohms will trigger the SCR with 2 A.

Overvoltage protection is provided by Q2. When the gate voltage exceeds 0.6 V, the SCR triggers and effectively shorts the output of the filter. The gate voltage is set by divider R5 and R6. Again, the current in Q2 lasts until the main circuit breaker trips. Q2 acts like a crow-bar placed across the output terminals of the filter.

The energy stored in the filter's capacitor and choke's magnetic field must be removed by the SCRs. Therefore, locating the SCRs after the filter but before the regulator minimizes the time needed to reduce the voltage to near zero, and protects the regulator as well as the load from overcurrents.

Designing a power supply is not a daunting task, although there are a lot of interrelated things to be traded off. From the theoretical point of view, power dissipation is a major item and the transistor data sheets must be read carefully. From a practical point of view, obtaining the wound parts, transformers and chokes, is a greater challenge.

A flexible bench supply can be built without a lot of head scratching. Or the trade-offs of a custom supply can be juggled with predictable consequences.

Erik Westgard NY9D
3990 Virginia Ave.
Shoreview MN 55126

QRP Asylum Update

The latest from our build-crazy ham ...

The decline of home equipment construction in amateur radio must surely rank as one of the more gradual of historical trends. In the September 1956 issue of CQ Radio Amateurs' Journal, *author Don Stoner W6TNS, gets on his soapbox: "Too many amateurs would rather put the green on the line and bring home a factory-made ham station, never more to get burnt by a hot soldering iron."*

Like those stories told by our grandparents of walking five miles to school each day uphill both ways in the snow, the truth about the beginnings of the "appliance operator" era and the decline of homebrewing is not so clearcut. In *Solid State Design for the Radio Amateur,* the eminently qualified home builders Wes Hayward W7ZIO and Doug DeMaw W1FB open their chapter on receiver design by pointing out that "by the time the 1930s arrived, it was common to find an amateur station with homemade transmitting equipment and a commercial-built receiver. This was the rule rather than the exception in the 1950s... ." They go on to say that the origins of the "appliance operator" era were really marked by the transition from homebuilt transmitters to factory-built transmitters during the rapid growth of the fairly complex single sideband technology.

One way to remove all guilt from "appliance operation" is to start scratch-building and operating your own equipment. For those who saw my last article ("QRP Drives Ham Nuts," *73*, 3/01), we built several transmitters from scratch and then some transceiver and basic receiver kits. Like the hams from the 1930s, we had a few problems with receivers. In this article, we'll try to reverse 70 years of history, and get some of these going.

W1FB Practical 20m DC Receiver, *W1FB QRP Notebook*, ARRL, 1991

Doug DeMaw W1FB says that simple receivers have a lot of flaws, but he has them in his books so that beginners can build their confidence and experiment. After salvaging several four-lead 40673 MOSFETs from some old CBs, I was ready to make another run at receivers. How much can go wrong in a receiver with just three active devices? This one went together easily on a piece of perforated board, which is apparently not a good way to build RF equipment (see the G3VA book summary below). This circuit design does not have an audio amplifier, so I used for the first time my Heathkit audio signal tracer, which was constructed and shelved over 25 years ago.

I heard a shortwave station right away, and had a feeling of pure joy as I listened, transfixed, for maybe half an hour. I also heard an incredibly strong image of our local AM broadcast station, so I built up the broadcast band filter from W4ZCB on page 169.

For the filter, I used a three- by one-inch piece of cheap phenolic perfboard, rejected by some as inferior to fiberglass perfboard, which you are not supposed to use anyway. Phenolic is cheap, you can buy it everywhere, and to my way of thinking it does not

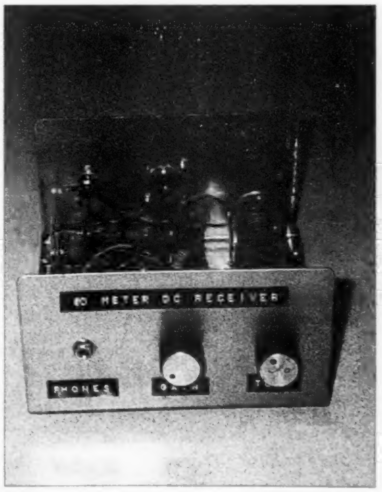

***Photo A.** W1FB Universal DC receiver in a Radio Shack cabinet. Note the W4ZCB broadcast filter.*

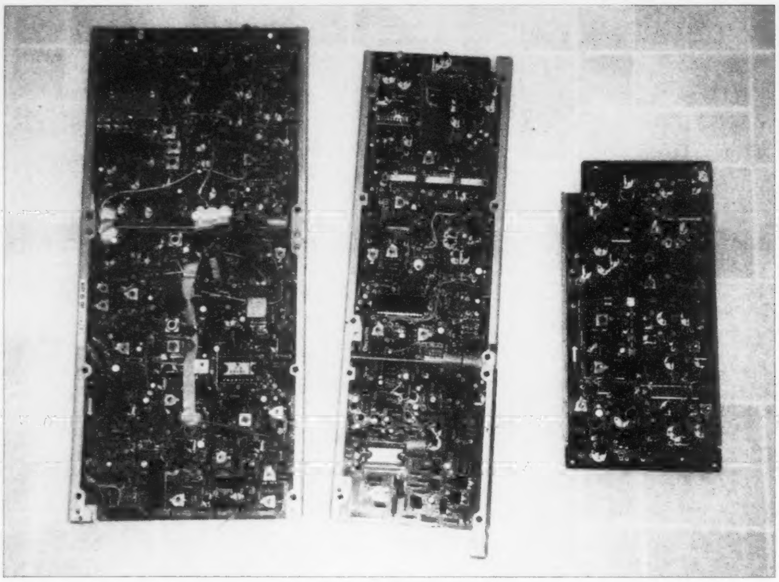

Photo B. Three of the seven boards from a 1986 vintage VCR — great source of QRP parts.

produce as toxic a dust when sanded or drilled, nor dull your drill bits as fast. Anyway, this design lets you keep the three RF chokes in the filter the suggested minimum of an inch apart, with one on each edge and one in the center. The add-on audio amp was another story — the text suggests the 741 op amp stage from Fig. 3-22. After two complete several-hour tries at that, I gave up and built an LM386 audio stage from Fig. 3-10 of the *W1FB Design Notebook* — success.

W1FB Universal Receiver (80m), *W1FB QRP Notebook*, ARRL, 1991 (note that the latest updated printing is 1999)

I was stymied on this one, in part by a mystery capacitor (C3), which did not have a value specified in my edition of the book. A helpful member of the Minnesota QRP Club suggested 100 pF, which was confirmed in an E-mail from FAR Circuits (who makes the boards), and on the corrected schematic in the newest, 1999, printing of the ARRL book. Probing the output with my signal tracer, I discovered that the front end was not working. The VFBO was not oscillating either, according to my Radio Shack frequency counter. I remembered only then that a 1 mH inductor is not the same as a 1 µH inductor. Once both of these were replaced with the specified values from the book, this receiver fired right up. I used a Dan's Miniature 10:1 Reduction Drive ($15.00), coupled to a home-made L-bracket on my tuning capacitor. This one also needed the high-pass filter from the back of the W1FB book to eliminate local AM interference, and works very well.

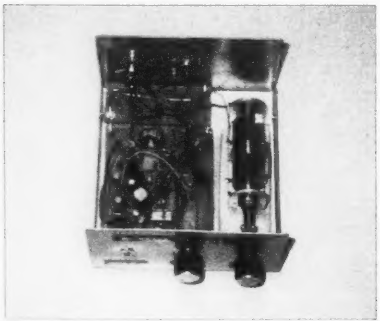

Photo C. W1FB Universal DC receiver with W4ZCB broadcast filter.

The WB8VGE Two-Fer (*73*, 4/1993, p. 53)

I was eager to get up on 20 meters. This one went together rapidly, but had two mysteries — an unlabeled cap on the diagram — which was on the base of the 2N3866 (it's 33 pF on the board layout), and no specification for wire gauge on the chokes and transformers. The board lettering says the key switch is a 2N3907, but the schematic suggests a (PNP) 2N3906. I guessed #24 on the wire, which is in an earlier Two-Fer article. The transformer is a small core that would not hold the 26 turns of #24 in a single layer, so I tried #26. Anyhow, it does not oscillate, and the 2N3866 just gets hot, so I'm not sure what is happening with this one. I did try two layers of #24 wire on the transformer — still nothing. My best guess here is that the crystals I have (I tried two) might be the wrong capacitance. So the idea would be to try to get the oscillator working by putting in some trimmer caps in the oscillator circuit. There was mention of a matching receiver — I am curious about that as well. I also went crazy trying to get the right leads on the metal TO-3 2N3866 matched up with the screening on the board, which was intended for the plastic TO-92 case.

Ramsey 30m Receiver

Like the other Ramsey kits I have built, this one is pretty basic but has good directions and goes together quickly. I had a bit of trouble aligning this one (the 80m version was a snap). After dragging out my signal generator, I found that I had failed to remove the internal capacitor on one of the IF cans as specified in the directions. With that done, the rig worked fine. If you have a good antenna and a tuner, these are OK but do not have enough gain to overcome a poor antenna. I ordered a multiturn pot for this radio, but will likely put my energy into building another W1FB Universal DC Receiver for this band.

Discarded VCRs as parts sources

Reuben Ruen WB0BWL, has been hearing of my QRP activities on his repeaters. He donated a collection of parts including a broken 1985-vintage VHS VCR. This one turned into a rich source of components. The one I got had over 35 marked RF chokes (these use the resistor color code; brown-green with black on the side is 15 µH). These have many small-signal transistors, diodes, NPO ceramic caps, and even some trimmer caps; and a color burst crystal in each unit. I went out and bought five more for two dollars each from a local TV repair shop, which had at least 50 on hand. I have a small Pierce oscillator running on 80 meters with parts from one, and would like to build a VCR-only 80m transmitter or receiver. One difficulty is an interstage transformer — the easiest way to go is a with a mail-order toroid.

I got some data back from Radio Shack on their latest (#273-103C) 100 µH RF choke — actually, the core:

Element: Fe_2O_3 ZnO CuO MgO
Initial Permeability: 220
Saturation Magnetization: 2300 gauss (150e)
Residual Magnetization: 900 gauss
Coercive Force: 0.55 Oe
Loss Factor: 4×10^{-5} (0.1 MHz)
Temperature Coefficients of Ui: 15–40 x 10^{-5} (20–40 degrees C)
Curie Temperature: >150 degrees C
Specific Resistivity: 10^7 (omega — infinity)
Density: 4.7 g/cm^3

The idea would be to develop interstage transformers with that core. It would be fun to scrap out a VCR and turn it into a radio in an afternoon with no advance planning. Our 1930s-era hams would no doubt approve.

RSGB Technical Topics Scrapbooks
by Pat Hawker G3VA

The ARRL has started importing these, and I saw a copy at Radio City. I was immediately impressed by the sheer number of QRP schematics in each volume — after bookmarking 10 good projects in the 1990–1994 volume, I ran out and got the 1995–1999 volume. While Pat says he is not a QRP person per se, he gets all the various amateur and RF engineering magazines from around the world, and pulls the goodies out of them each month for his RSGB Technical Topics articles, which are captured in these scrapbooks.

That was where I learned that using perfboard for RF was bad (W1FB seems to think it's OK, though), and that tinning the ends of stranded wires before putting them on screw-type terminals blocks (which I have been

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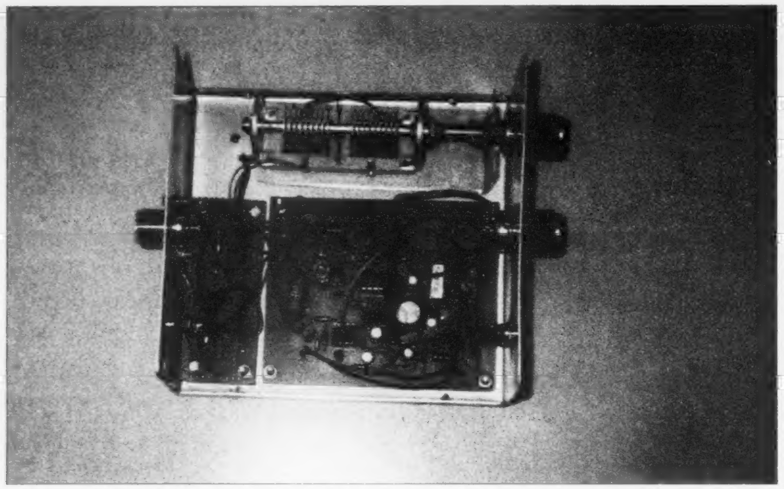

Photo D. *View of W1FB Universal DC receiver in Radio Shack cabinet. Note reduction drive and W4ZCB broadcast filter.*

doing for at least 25 years) will tend to cause the solder to cold flow and the connections to loosen and fail after a year. Pat was also around in the hobby for the beginnings of the W1FB/W7ZIO era, which I missed. I found a nice W7ZIO article on MOSFET power amplifiers, which had not revealed itself before under the rather basic indexing system on my ARRL *QST* CD-ROMs. There is only one minor annoyance with these books. When the RSGB redraws schematics, they use British component-value notation. I found an article in the book that I had in its original American form and built my own conversion table, shown in **Table 1**.

30m W1FB EX-1 Transmitter, *W1FB QRP Notebook*, ARRL, 1991 (note that the latest updated printing is 1999)

There is something confidence building about a PC-board-based project. All you have to do, in theory, is to gather up the parts and stuff them in. In this case I did just that, and nothing happened. I tried different crystals, and tested and rechecked every part. One time-saver is a transistor tester. I have a 20-year-old Radio Shack model, but they have a brand new one out for under $20. I finally noted a comment from W1FB about adjusting some of the caps in the oscillator to match the crystal. I put in some trimmers and got the crystal to oscillate, but did not get anywhere near full output. It runs great with my finger on one of the crystal terminals, hardly a practical solution.

More projects

As I write this, another stack of boards has arrived from FAR. These include another W1FB Universal DC Receiver, a W1FB 40m transceiver that I want to convert to 80m, and a W1FB Universal VFO. I also ordered the filter crystals for one of the more complex W1FB superhet receivers as well. I decided for the moment not to order the surface mount kit from the Norcal Site — after building and rebuilding several 1.2 GHz amplifier kits for a repeater project, I find I can now reliably solder and desolder surface mount parts. For desoldering you need a steady hand and a supply of top quality copper desoldering braid, with rosin from your local TV parts supplier.

Sources

Amateur Radio Consignment Center, 623 Prior Avenue North, St. Paul, MN 55104. (651) 644-3102. ARRL, [http://www.arrl.org].

ARRL QRP Notebook, Doug DeMaw, ARRL, First Edition, 1986. The AL Factor discussion is on page 64. (Out of print.)

CQ Radio Amateur's Journal, [http://www.cq-amateur-radio.com]. (The 1956 issue cited was edited by Wayne Green W2NSD.)

FAR Circuits, 18N640 Field Court, Dundee, IL 60118; (847) 836-9148 voice/Fax (boards and matching article reprints);[http://169.207.3.68/~farcir/index.htm].

Continued on page 57

100n = 0.1 µF
10n = 0.01 µF
3n3 = 0.0033 µF
1n = 0.001 µF
2k2 = 2.2 kΩ
1m5 = 1.5 megohms

Table 1. *Conversion table.*

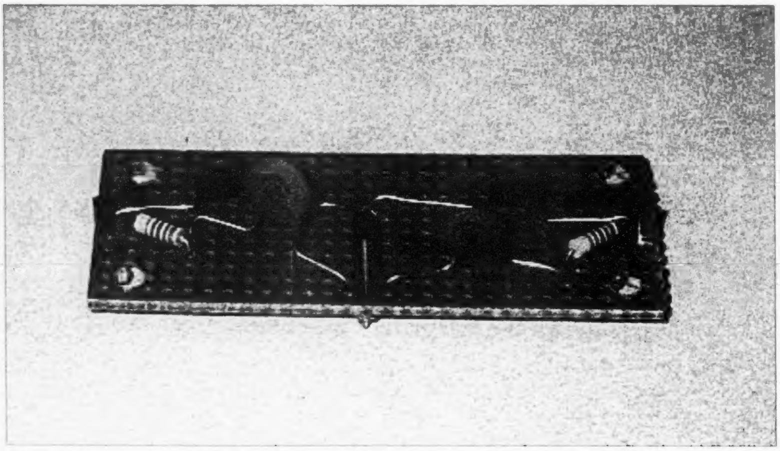

Photo E. *High-pass filter from* W1FB QRP Notebook *by W4ZCB, p. 169.*

Hugh Wells W6WTU
1411 18th Street
Manhattan Beach CA 90266-4025

Your Long-Lost Transistor Notebook

Part 1 of 4.

Are you a tinkerer and experimenter who enjoys working with transistors? If so, then how do you work out the various parameters such as bias, resistor values, linearity, input/output impedance, gain, etc., that surround a transistor used in your circuits?

If you're like me, you want to go beyond just copying someone else's schematic when you build a project and tailor it to suit your needs. Yes, working with transistors in audio applications is pretty much cut and dried these days because most of the common circuit designs have been laid out in schematic form for us to follow. But if you'd like to see how some of the circuit values were derived, then let me take you on a tour of how transistors react and how you can derive most all of the circuit values for your next project.

Through the use of the "tools" developed during this tour, you will be able to characterize the transistors in your "junk box." After characterizing your transistors, you will be able to use them in projects of your own design with all of the correct values identified.

Our tour of "Long-Lost Notebook" will provide stops at the following subjects:

- Testing transistors
- Collecting data
- Plotting curves
- Characteristic curves
- Dynamic transfer characteristic curve
- Power dissipation
- Load lines
- Stage gain
- Linearity of operation
- QOP (quiescent operating point)
- Operating range (signal amplitude/limitations)
- Calculating resistor values
- Input and output impedance
- Frequency roll-off

The advent of the computer, and the myriad of computer programs available for circuit design, has taken the work out of setting up circuit values and removed all of the guesswork. But as an experimenter, it's nice to "see inside" the design and find out how and why the values were chosen. To get inside of the circuit, it's necessary to focus on how a transistor reacts to a particular electrical stimulus, and with the wide variety of transistors available, each will have its own set of reactions.

Working with transistors involves developing a set of "tools" that will allow a specific transistor to be examined. The oldest, and still the most useful, tools involve characteristic curves representing how a specific transistor responds to a surrounding set of circuit conditions.

To maintain a focus on understanding how a transistor reacts, the tour will be limited to Class-A transistor operation with audio signals. The transistor may react in a similar manner but the rules change somewhat when an RF environment exists.

Although some characteristic curves are available for some transistors, they are rarely published these days unless you have the opportunity to obtain data sheets from the device manufacturer. Even though the data sheets might be available, developing your own set of curves will tremendously increase your understanding of how a specific transistor will react. I've included several sets of characteristic curves in order to illustrate what the curve looks like and how they are used to examine a transistor. I've chosen three common NPN transistors and one N-channel FET as examples. **Fig. 1** shows the characteristic curves for a 2N3904, an NTE-69, and an MPF-102. **Fig. 2** shows three sets of curves for the 2N4401 representing three different Ic current ranges. The upper set of 2N4401 curves also shows the rated power dissipation of 310 mW.

Continued on page 28

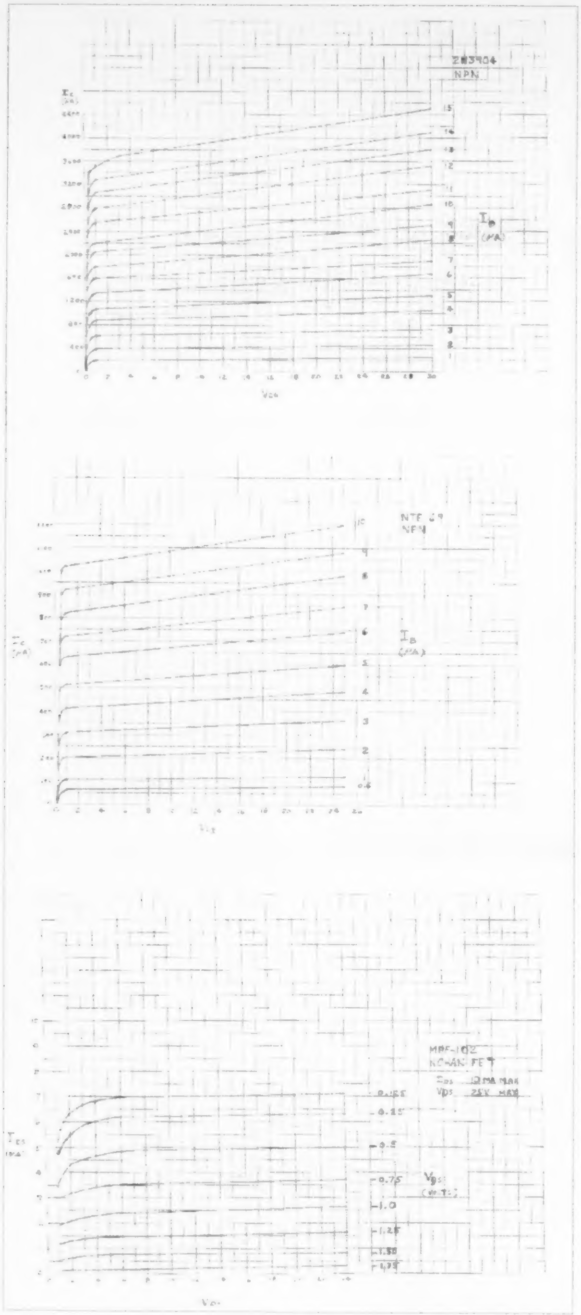

Fig. 1. Characteristic curves for two transistors and one FET: 2N3904, NTE-69, MPF-102.

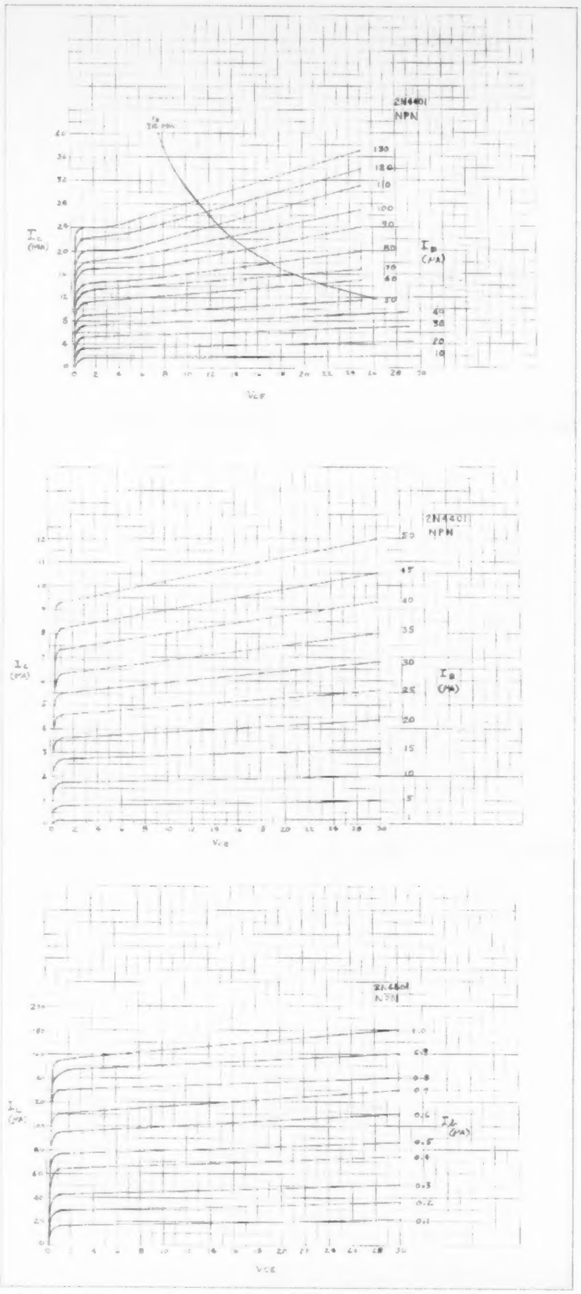

Fig. 2. Three characteristic curves for three different Ic ranges for a 2N4401 transistor. The upper high current set of curves shows the rated power dissipation curve for 310 mW.

Your Long-Lost Transistor Notebook

continued from page 27

The curves

Curves are plotted on graph paper in order to provide an easy means for reading and extracting accurate data. The two main coordinates for the charts shown in **Figs. 1** and **2** are Vce (voltage between the collector and emitter) and Ic (collector current). A curve is plotted using stepped values of Ib (base current) for all values of Vce and Ic within the operating range selected for the chart. As shown in **Fig. 1** for the 2N3904, the highest current is 4.4 mA and the highest voltage is 30 V even though the transistor may be capable of higher values. Other voltage and current limits may be selected to meet your desired circuit operating parameters, as shown in **Fig. 2** for the 2N4401. As indicated earlier, some transistors will operate at very low voltage and current values, and a set of characteristic curves may be generated to support that application as shown in the lower chart of **Fig. 2** for the 2N4401. I've found it to be a lot of fun pushing transistors to their limit, particularly to the low current and voltage side of their capability.

Because usage applications vary somewhat between projects, curves may be generated with Ic values in the low, medium, and high ranges to meet the requirements of the project. One of the objectives of this tour is to provide the insight that allows transistors to be used to suit the project.

Although I'd used transistors for many years, I wasn't really aware of how low an operating current value might be and still have a transistor react correctly. With that in mind, I'd like to tell you a short story about low-current transistor operation that brought things into focus for me. Many years back, a ham acquaintance was operating a manufacturing company making heart pacemakers. Pacemakers operate off of battery power, and the battery is expected to last for very long periods of time. When we as experimenters build up a transistor circuit, we rarely give any consideration for the amount of current that the device draws because ample current is normally available from a power supply. But when discussing the current being drawn by the transistors used in the pacemaker, I was told that the current had to be limited to the very low microampere range in order to conserve battery life.

Stepping away from the pacemaker experience, the question arises as to how you determine the circuit values that continue to allow the transistor to operate at low current values. The first question that comes to my mind is what transistor will operate in the microampere region, and then how do you go about determining the circuit values to be used with it? Keep in mind that the resistors used in the circuit also draw current.

It's obvious that manufacturers' data sheets provide little if any insight into answering the questions regarding low current operation; therefore, it is up to the ham experimenter to set up a test for obtaining the desired information. Although it's unlikely that a ham would, in general, operate a transistor in the very low microampere region, it's certainly within his capability to evaluate the transistor at low current values if he desires to do so. The techniques provided in this tour are the key to answering many of the questions that arise.

Collecting curve data

Perhaps the most fun an experimenter will have with characteristic curves as a project is in developing a valuable database for the transistors that he has in the "junk box." If you're like me, you've collected transistors from circuit boards and other places, and have put them away for use in future projects. But many of those devices have strange part numbers that are not traceable to a data source. Well, now is the time to pull those transistors out of the "junk box" and find out something about them by developing a set of characteristic curves.

The test equipment needed to develop a set of curves for a transistor involves two variable voltage power supplies and three digital multimeters, along with a few selected resistors. **Fig. 3** shows the circuit that I've used to develop curve data for small-signal transistors such as the 2N2222, 2N3906, 2N4401, etc. **Fig. 4** shows the same setup modified slightly for developing the curve data for the MPF-102 N-channel FET.

My power supplies are built around LM-317 variable voltage regulators, providing a controlled output voltage from about 1.2–30V. Metering for my test circuits was done with inexpensive digital multimeters, but analog VOMs would work well.

Collecting data from the tests performed requires some uniformity and consistency in the way it is done. Because junction transistor characteristic curves are reasonably "straight" after passing to the right of the knee, only a few verification points need to be noted. Contrary to the above, however, if the power dissipation within the device rises and/or approaches the

Continued on page 30

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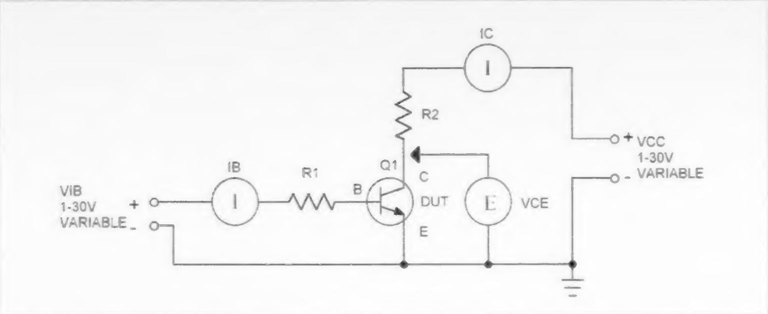

***Fig. 3.** Test circuit for collecting Vce-Ic characteristic curve data from junction transistors. R1 = 10k to 3 meg as needed. R2 = 150 ohms to 4.7k as needed.*

Ib = _____	
Vce	**Ic**
0.5	
1.0	
5.0	
10	
15	
25	

***Table 1.** Suggested table used for collecting test data. A separate table is required for each base current value to be examined.*

Your Long-Lost Transistor Notebook

continued from page 29

rated power dissipation, the plotted curves will arc upward with increased Vce values.

Table 1 shows a table format that is useful for collecting data; one is required for each base current value that is to be plotted. Base current values are selected for uniformity in incremental steps that apply to each transistor. The lower Vce values are used to identify the curve of the knee, and once found, only a couple of data points are then required to establish the slope of the curve.

Developing characteristic curve data for an FET follows a similar pattern as that of the junction transistor. However, the gate of an FET is voltage-operated, not current-, and the output (drain) characteristics are similar to those of a junction transistor.

To accommodate the voltage control of the FET gate, a voltage divider is used to establish the voltage applied. In addition, for an N-channel FET, the gate voltage polarity must be negative.

There are a wide variety of FETs available, and each type must be handled appropriately. The JFET, such as the MPF-102, is the easiest to work with when being tested using a simple test setup as shown in **Fig. 4**. A data table similar to the one shown in **Table 1** is used for collecting test data. It is necessary to collect a larger number of Vds test points for an FET because the curves are generally more "curved," not straight as shown for a junction transistor. A set of MPF-102 characteristic curves is shown in **Fig. 1**.

In preparation for running the tests and collecting data, the test setup and anticipated ranges should be verified in advance. To assist in obtaining the desired data prior to running the final test, the following steps are suggested to establish the desired data range:

1. Power supply voltages set to the lowest value.
2. Resistors connected correctly.
3. Meter ranges set and verified.

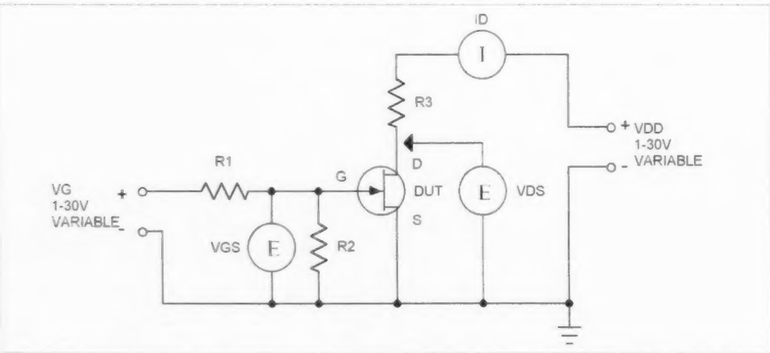

***Fig. 4.** Test circuit for collecting Vds-Id characteristic curve data from a junction FET. R1 = 1 to 5 megs as needed. R2 = 10k to 100k as needed. R3 = 150 ohms to 4.7k as needed.*

4. Sticky labels attached to the meters indicating Ib, Ic, Vce, respectively.
5. Raise the base current (Ib) to the first desired value.
6. Note the rise in Ic (collector current) as Ib is increased.
7. Raise the Vce power supply and note the rise in Ic. It may rise rapidly approaching the knee — and will rise slowly after passing the knee. Return the power supply setting to LOW.
8. Raise Ib to the highest expected value for the chart being developed.
9. Note the increase in Ic.
10. Raise Vce and note the rise in Ic. Is it within the desired value for the chart's upper current?
11. Should the Vce not rise to the desired upper value at maximum Vcc, then decrease the value of R2 and repeat step 10. Use the highest value of R2 that will allow Vce and Ic to reach the desired value for each curve.

NOTE: Power being dissipated by the transistor can be determined by multiplying Vce x Ic. The resulting power value must not exceed the rated value for the device.

12. When satisfied that the setup is operating as desired, run the test for each set of Ib values and record the data.
13. Return the Vce power supply to the lowest setting after each set of curve data is obtained.
14. Collect data for each transistor you desire to understand and in preparation for plotting the data on graph paper. Record the data in a format as shown in **Table 1**.

Continued on page 57

73 Review

Jim Pickett K5LAD
9829 N. 151st East Avenue
Owasso OK 74055

Thumbs Up for ROTOR-EZ

This handy add-on fits inside *your control box.*

Back in the '70s, when I owned and operated a ham radio store, many of us in the ham population were excited when we heard that computers had become generally available. The year was 1975, and it was before the appearance of the Radio Shack TRS-80 Model I, the Apple, or the Commodore Pet. A company called MOS-Technology came out with a computer prototype board called the KIM-1, all neatly packaged on an 8.5" by 11" printed circuit card.

The KIM-1 had 1K RAM, 2K ROM, a hexadecimal keypad, and a line of 7-segment LED readouts along with lots of documentation; it sold for $289. The KIM-1 was designed for companies as a prototype board to allow them to experiment with the newly available computer technology. Quite a few hams, however, saw this new technology as a brand new experience, and were eager to get one.

I became a dealer for the KIM-1 line and sold dozens of these little boards, along with the wonderful handbook someone had written called *The First Book of KIM*. The question which was often asked by the less-than-excited customer was, "What can you do with it?"

I owned one of the KIM-1 boards, too, and was often asked that question. The easy answer was, "You can do EVERYTHING with a computer like this," but many wanted me to be more specific. The primary answer I used to give was, "As a ham, I can hook it up to my antenna rotator. Then, when I hear a station in a foreign country and need to re-orient my beam, I only need to enter their call and the computer will automatically look them up, determine their direction from me, turn my antenna to the correct position, and then shut itself off." Good answer, huh?

Now, almost exactly 25 years later, I am able to accomplish this task, thanks to the help of a new product from Idiom Press called ROTOR-EZ. It comes as a kit and can be purchased in either of two forms: the rotor control by itself or the same board complete with an RS-232 interface to allow attachment to a computer.

The ROTOR-EZ is designed for the Cornell-Dubilier Electronics (CDE), which later became Hy-Gain, and is now MFJ, Tail-Twister or Ham IV rotator. The primary reason for specifying those models is because they use the control box which has the individual switch paddles for turning clockwise or counterclockwise, and also has a separate switch for the brake. The earlier models of the CDE rotors used a single, center-positioned, direction control switch and did not have a separate switch to allow for controlling the brake.

The ROTOR-EZ board fits conveniently inside the rotator control box. There are few outward indications that the control box contains anything more than when it was received from the manufacturer, "at birth." The secret, however, lies inside the box.

The standard ROTOR-EZ board, which does not have the computer interface, allows the user to turn the calibration control pot on the rotor control box to set the meter to the direction in which they wish the rotor to point their array. Then, a tap on the brake paddle causes the rotor to begin turning. Rotation can be stopped at any time by another press of the brake paddle. A multicolored LED changes from red to

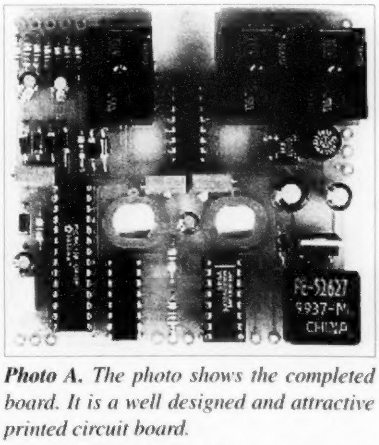

***Photo A.** The photo shows the completed board. It is a well designed and attractive printed circuit board.*

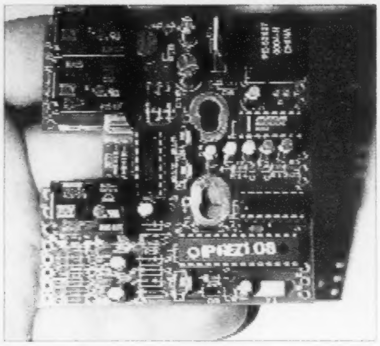

Photo B. *The relays are on the left. The larger chip in the lower right is the programmed PIC.*

orange to green as it approaches its final location. Watching the color of the LED lets you know how close you are to the final destination direction.

The board has several really nice features both built-in and user-selectable by using onboard jumpers. The 5-second brake-set delay is standard and very desirable to keep the brake from slamming into the internal stop grooves and damaging the tower, and/or beam, and/or rotator. Note that if you have added a brake delay to your box already, it will need to be removed. One programmable feature is especially for the Tail-Twister rotor, which often has a hard time moving from an initial start command. If this feature is jumper-selected, the ROTOR-EZ will command it to go in the reverse direction for a second and then reverse direction to head off where you want it to go … just like we have to do manually with a Tail-Twister. I thought that was an especially nice addition, since I am using my ROTOR-EZ on a Tail-Twister.

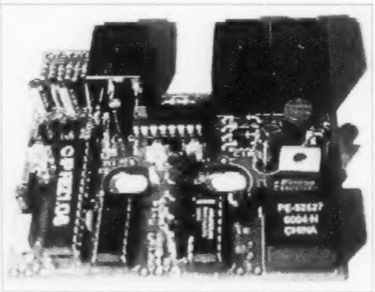

Photo C. *The board is easily constructed when you take your time.*

You can also jumper select a feature which removes power when rotation gets within 3 degrees of the destination point, to let your array coast to its final spot. Another jumper-selectable feature stops the rotor within 5 degrees of the end of rotation points to protect the rotor and tower from severe stress. Again, these are jumper-selectable,. and if you do not desire to implement them, you have that option.

A new programmable feature, which has been added to the latest version, is especially for those who have a 40 meter beam on the same mast as a beam for one or more other bands. Often, to counteract the interaction between these antennas, the 40 meter beam is mounted 90 degrees off from the tribander's heading. ROTOR-EZ can be wired so the meter shows the direction of the tribander or, by throwing an added switch, shows the direction 90 degrees from the standard display where the 40 meter antenna is aimed. This is user-selectable, and the switch becomes the jumper. Leaving the added switch off allows the display to work normally and display only the one direction. In the offset mode, one of the LEDs on the control box panel will blink a bit at a different rate so as to remind you that the display is showing an indication for the offset antenna and not the standard array. I did not try this feature, since I did not have a 40 meter offset beam on my tower.

The board can also be purchased with the extra components to allow RS-232 attachment and control. The board is prepared for the additional components and the silk-screening is there to show the appropriate parts placement. RS-232 interfacing is through a DB-9 connector attached to a short cable which is wired to exit the back of the rotor control box. The instructions suggest that if you buy the standard board and want to add the RS-232 feature later, this is easily done. Since I especially needed and wanted the computer interface, I chose the board kit with the RS-232 interface.

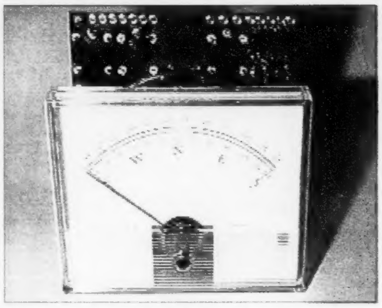

Photo D. *The board shows from behind the body of the meter.*

The ROTOR-EZ kit comes with a beautiful double-sided, silk-screened, glass-printed circuit board with plated-through holes. It was obviously professionally manufactured. The instructions were clear and easily followed but the parts are small and my old eyes are not what they used to be.

Back in the 1970s, I remember building a BIG Heath color TV set from the kit — from unpacking to turning it on took me a total of 36 hours. Ah, the enthusiasm of youth. That, too, is a thing of the past. I spent something like 10 hours on the ROTOR-EZ board, checking and double-checking, reading and rereading, wiring, and checking some more. In my younger days, it would have taken probably 4–5 hours — tops. Since parts are small, polarities are important, and space on the board is tight, I chose to take a bit more time and use the old carpenter's axiom — Measure Twice, Cut Once.

A couple of the capacitors are accounted for in the instructions and have homes (and holes) on the PC board, but their locations are not silk-screened on the board. An enclosed letter from another ROTOR-EZ board builder commented about lack of silk

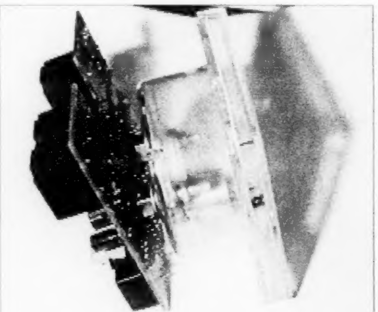

Photo E. *The board attaches to the large screws on the rear of the meter — although the nuts had not been tightened when this picture was taken.*

screening for these two components and, although I read that message, I placed one of the capacitors in the wrong spot anyway. There are holes on the board for jumpers, to customize the operation, and I mistakenly borrowed a couple of those jumper holes. I was able to catch the error during one of my rechecking or re-rechecking activities. Just a word of caution here should be sufficient.

The board uses a preprogrammed PIC chip and includes a socket just in case the user chooses to trade for a different preprogrammed PIC. The instruction sheet offers to burn a different PIC if the rotor used is on a side-mounted antenna setup which cannot (or should not) try to turn a full 360 degrees. The cost of this specialized chip was not given, but a call or an E-mail to the company should quickly provide that information.

The ROTOR-EZ board attaches to the two screw posts on the rear of the rotor control box meter. If there is already a board attached to your meter, as there was on my Tail-Twister control box, it must be removed completely with all its attached wires. The ROTOR-EZ board replaces the original board. The instructions caution the builder to make a sketch of where the wires go, just in case you should ever desire to put the box back to its original condition. I even removed the original LEDs (CW, CCW, Brake Release), since the kit came with new ones. This allowed me to keep all the wires on my original board. As a note, I placed a piece of white plastic tape on each wire and wrote to show where it had been attached. I'll probably never need to mess with that original board and its wires again, but if I did, those tape notes should save a lot of time.

The added multicolored LED is above the word BRAKE on BRAKE RELEASE. A hole must be drilled, and the LED and mounting hardware comes with the kit of parts. This is the LED that changes colors as the array turns from starting position to the final destination position.

One thing that troubled me in the design was the use of a small, nonstandard fuse on the board. The fuse is rated at 1.5 amps and is in a round can package like a TO-5 transistor. The two leads are soldered to the board. I certainly like the idea of fusing the board but if that device blows, I can't imagine the replacement being very quick or easy to locate. I hope I never have to worry about that.

My ROTOR-EZ is used with the logging program LOGGER by Bob Furzer K4CY, ex-N6BFM. Note that LOGGER is freeware, i.e., costs nothing. Bob had recently added rotor control to the program but nothing was mentioned about ROTOR-EZ. The two rotors that were supported were the Yaesu GS-23/GS-232 and the RC-28000 (M2 rotors).

I E-mailed the ROTOR-EZ company and asked if their board would work with the Ham IV and Tail-Twister rotors. Idiom Press quickly answered back that his board uses DCU-1 protocol, which was the same as with the Hy-Gain automatic rotor. He offered to correspond with the author of the LOGGER program about whether it would work. I gave him Bob's name and E-mail address and he sent Bob an E-mail inquiry including spelling out the protocol used by DCU-1 rotors.

In less than 45 minutes, I had a return E-mail saying that the new protocol had been incorporated into LOGGER and Bob needed someone to beta test that feature. The entire set of E-mails, from inquiry to having the new program which interfaced with the ROTOR-EZ board was less than 3 hours. Pretty neat, huh?

The LOGGER program is available for free download on the Internet, but at this writing, plans were being made to change to a different source due to heavy traffic. A quick search for LOGGER or logging programs should provide a place for you to download the program. As of the date this was submitted for publication, the URL to download the program was: [http://www.qsl.net/kc4elo/].

Cost of the standard ROTOR-EZ board is $99.95 plus $5 shipping in the USA ($10 for outside the USA. The same board with the additional components needed to allow RS-232 interfacing is $129.95 plus $5 USA shipping.

CALIBRATE
OFF
ON
BRAKE
RELEASE
CCW
CW

***Photo F.** The added LED shows between the two knobs and above the original BRAKE RELEASE LED.*

The company has a Web site at [www.idiompress.com].

A recent trip to the Idiom Press Web page directs viewers to another site where, for a fee, the ROTOR-EZ kit will be built for you and/or installed in your rotator control box. This page also offered a list of troubleshooting suggestions, should you run into a problem.

If you have ever had the desire to incorporate a rotor-computer control, or to have a manual/automatic rotor control, or even to add a brake delay to your Ham-IV or Tail-Twister rotor, then ROTOR-EZ is for you. Automation is great when applied to the ham radio hobby. Let's see, now … all I need is some sort of device to actually make the contact …

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Read All About It!

Part 8 of good stuff from The Hertzian Herald.

All about Babbage's Analytical Engine; Who's on first?; and What's in a name?

In 1833, Britannia ruled the waves. England's vast colonial empire was held together by the Royal Navy and the merchant marine. But ships were occasionally going to the bottom because the navigator said they were 100 miles from shore, when in fact they were literally on the rocks.

Navigation, at that time, was done by sighting on a few selected stars, checking the ship's chronometer (a very accurate — for the time — clock), and looking up your position in a book of navigational tables. (Sorry, no LORAN or GPS in 1833.) These tables were produced by rooms full of calculators — but at that time a calculator was not a pocket-size, or even desk-size, machine — it was a human being. Teams of calculators were hired to compute the values that went into the tables by hand, with pencil and paper.

Of course, these human calculators occasionally made a mistake, and that mistake occasionally resulted in a ship going down. The British Post Office, which seemed to be in charge of everything in England that wasn't nailed down, was not amused. So, when a gentleman named Charles Babbage told them that he could build a machine that would generate the table values and stamp them into printing plates — entirely eliminating the chance of human error — they gave him a pile of money and told him to go ahead.

Babbage called his machine a difference engine, because it produced its tables by using a process consisting mainly of a series of subtractions. It was to consist of hundreds of gears and levers, and was to be driven by a steam engine. Unfortunately, midway through the construction process, Babbage had a brainstorm.

"The difference engine can only do one job," he said. "But if I make it several times more complicated, I'll be able to configure or 'program' it to solve ANY mathematical problem. I'll call it the Analytical Engine." So he pulled his machinist off the difference-engine project, and told him to start over on the Analytical Engine.

This was not a good move, because (1) the requirements on the new system completely overwhelmed the precision available with the machine tools of the day, (2) Babbage was already involved in a dispute over who owned the tools that the machinist had developed for the project, and (3) the government was already balking at the cost of the difference engine. (Pushing the envelope of a new technology, a product that's obsolete before it goes into production, labor problems, cost overruns; where have we heard all that before?)

The end of it was that Babbage's projects were both canceled before they were fairly started, but computer historians agree that, if it had been built, the Analytical Engine would have been the world's first digital computer. It had all the essentials: a Central Processing Unit (he called it the Mill), a Memory (Store, to Babbage), Input, and Output units. Most important, it was to have its program stored in memory, a defining feature of the modern computer.

Babbage is generally credited with the invention of the digital computer, even though his design was never built, let alone operated. By this standard, Samuel Langley, or even da Vinci, should be credited with the invention of the airplane. Langley actually built

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a flyable plane before the Wright brothers, but a caught rope caused it to crash on its first trial. Langley's plane was rebuilt and flown after the success at Kitty Hawk, but we all know who gets credit for inventing the airplane.

Ada, Countess Lovelace, the niece of the poet Lord Byron, was an acquaintance of Babbage and a promoter of his inventions in the fashionable circles of London. Several moderns have attempted to cast her in the role of the first computer programmer. Alas, she never wrote a line of programming in her life — there was no computer to write a program for! But facts must never be allowed to get in the way of a romantic story. When the U. S. Defense Department set out to form a standard programming language several years ago, they called it Ada.

Who's on first?

The conventional American view is that nothing much happened in computers from the time of Babbage until the mid-1930s, when Howard Aiken began work on the IBM/Harvard Mark I, which was finished in 1944. The objective was similar to Babbage's, but with navigation under better control since the advent of radio, the tables to be calculated were ballistics — the aiming of big guns. A complete book of tables would require over two million 8-digit multiplications, an overwhelming task for humans. The Mark I was composed of motors, gears, and relays — a 51-foot-long, 8-foot-high monster. It did a 23-digit multiplication in 3 seconds. But it was not electronic.

J. Presper Eckert and John Mauchly at the University of Pennsylvania developed a fully electronic computer for doing ballistics tables, which became operational in 1946. It was called ENIAC (Electronic Numerical Integrator And Calculator), and was 1000 times faster than the Harvard Mark I.

It used 18,000 vacuum tubes, occupied a 30- x 50-foot room, and consumed 150 kW of power. It had a 100-kHz clock rate, and operated with decimal, rather than binary numbers. But it was "programmed" by hardwire patch cords. Real computers today are expected to store their programs in memory, the same as data.

The EDVAC, built in the next room to the ENIAC at the U of PA, came on line in 1950. It was the first operational stored-program electronic digital computer in the US.

Eckert and Mauchly started a computer company which was soon bought out by Remington Rand Corp. This company delivered the first commercial digital computer in the US in May of 1951. It was called UNIVAC, for Universal Automatic Computer. It contained 5,000 tubes, had a 2.25-MHz clock rate, and a memory of about 6 kilobytes. UNIVAC was used amid great fanfare to "predict" Eisenhower's election in 1952, and to "formulate" the questions for the popular TV quiz show, "The $64,000 Question." These stunts undoubtedly had much to do with the public perception of the computer as a "giant brain."

The above, as I said, is the traditional American view. Now, for some lesser-known facts:

1. John Atanasoff, at Iowa State College, was using vacuum tubes in a prototype digital computer in 1941. Mauchly visited Atanasoff in Iowa that summer, and the ENIAC surely owed much to what he learned there.

2. Konrad Zuse in Germany proposed a computer using 2,000 tubes for calculation of stress on aircraft wings. The Third Reich would not pay for the tubes, so he built, in 1941, a machine using 2,600 relays. It was successful, but was destroyed by an Allied bombing raid in 1945.

3. The British had built a computer-like machine to assist in breaking the German Enigma code in 1943. It contained 1,500 vacuum tubes, and was called Colossus. One of its progenitors was Alan Turing, who laid much of the theoretical foundation for later computer development, and whose tragic life was the subject of a PBS docudrama.

4. Kilburn and Williams developed a fully electronic, stored-program computer, which they called the Mark I, at the University of Manchester, England, in 1948 — predating the EDVAC by two years.

5. Ferranti, Ltd., in England, delivered a commercial electronic computer

Continued on page 57

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CALENDAR EVENTS

Listings are free of charge as space permits. Please send us your Calendar Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the September issue, we should receive it by June 30. Provide a clear, concise summary of the essential details about your Calendar Event.

JULY 4

BRESSLER, PA The Harrisburg Radio Amateur Club, W3UU, will hold its Firecracker Hamfest in celebration of its 29th year, at Emerick Cibort Park, Bressler PA. Set up on July 3rd from 6 p.m.–9 p.m., or July 4th at 6 a.m. The park opens to the general public at 8 a.m. July 4th. 80 covered tables, all with electricity, only $12 each, prepaid by June 1st. All tables paid for after July 1st will be $15 each, prepaid on a first come first served basis. 48 hour cancellation notice required for refunds. Contact *Pete deVolpi K3PD, 408 Hillside Ave., New Cumberland PA 17070. Weekday phone (717) 705-1370, weekends and evenings 6–9 p.m. (717) 938-8249. E-mail [w3uu@aol.com]*. See the Web site at *[http://members.aol.com/w3uu/]*.

JULY 7

OAK CREEK, WI The South Milwaukee ARC Inc. will hold its 33rd annual Swapfest on July 7th, at American Legion Post #434, 9327 S. Shepard Ave., Oak Creek WI. The event will run 6 a.m.–2 p.m. CDT. Free parking. Picnic area and limited overnight camping are available with plenty of nearby hotels/motels. Hot and cold beverages will be served. Admission is $5 for buyers or sellers. This includes a free "happy time." Talk-in on 146.52 simplex as well as on many of the local repeaters. A flyer with map may be obtained by writing to *The South Milwaukee Amateur Club, P.O. Box 222, South Milwaukee WI 53172-0102.*

JULY 14

LOVELAND, CO The Northern Colorado ARC will present the "Northern Colorado Superfest 2001" on July 14th, at the Larimer County Fairgrounds in Loveland CO. Doors open at 8 a.m. Talk-in on 145.115 rptr. Activities include swap meet, tutorials, demos, VE exams, and "QRP Corner." Guest speaker Paul Harden NA5N will give a presentation on Solar Activity and HF Propagation at 11 a.m. Admission $4, tables $12 each. To reserve tables, call *Rod Cerkoney N0RC, (970) 225-0117, or E-mail [n0rc@arrl.net]*. Vendor set up Friday at 5 p.m. and Saturday at 6 a.m. For more info see the Superfest 2001 Web site at *[http://www.qsl.net/n0rc/hamfest]*.

JULY 15

VALLEY FORGE, PA The Mid-Atlantic ARC will sponsor a hamfest July 15th, starting at 7 a.m. at Kimberton Fire Company Fair Grounds, Rte. 113, south of intersection with Rte. 23. Indoor-outdoor space: indoor tables with electricity 1–4 $10 each; 5 or more $8 each, not including admission. Tailgating $6, no reserved tailgate space. Admission $6. Talk-in on 146.835(-) and 443.80(+). Computer and electronics hobbyists are welcome. Write to *MARC, P.O. Box 2154, Southeastern PA 19399;* or call *Bill Owen W3KRB at (610) 325-3995.* E-mail *[gem@op.net]*; Web site at *[http://www.marc-radio.org/hamfest.html]*.

WASHINGTON, MO The 39th Annual Zero Beaters ARC Hamfest will be held Sunday, July 15th, 6 a.m.–2 p.m., at Bernie E. Hillerman Park (Washington Fairgrounds). Free parking and free admission. Technical sessions, ham radio and computer flea market, ham radio demonstrations. Talk-in on 147.24(+) rptr. Watch for green on white hamfest signs. VE exam registration starts at 9 a.m. Walk-ins welcome, limit 60. Bring original license and a photo copy. For info SASE to *ZBARC VE Exam, P.O. Box 1305, Washington MO 63090.* For hamfest info, contact *Zero Beaters ARC, P.O. Box 1305, Washington MO 63090; 147.24(+) rptr.; Keith Wilson K0ZH, (636) 629-2264, fax (636) 629-1196;* or *Bob Goza W0BOB, (573) 484-3718, [w0bob@arrl.net]*. Check the Web site at *[www.yhti.net/~w0bob/zbarc]*.

JULY 22

SUGAR GROVE, IL The Fox River Radio League will hold their Annual Hamfest at Waubonsee Community College, Rte 47 at Harter Rd., Sugar Grove IL (5 miles NW of Aurora). Doors open Sunday at 8 a.m. Set up Saturday at 7 p.m., Sunday 6 a.m.–8 a.m. VE exams at 10 a.m. Bring original license, copy of license, and photo ID. Talk-In on 147.210(+) PL 103.5/107.2. Contact *Maurice L. Schietecatte W9CEO, c/o FRRL, P.O. Box 673, Batavia IL 60510. Tel. (815) 786-2860, or E-mail to [w9ceo@arrl.net]*. The Web site is at *[http://www.frrl.org/hamfest.html]*.

JULY 27–28

OKLAHOMA CITY, OK The Central Oklahoma Radio Amateurs will sponsor "Ham Holiday 2001" at the Oklahoma State Fair Pk., northeast of the I-40 and I-44 intersection. This will be their 28th annual event. The event will be held in the Hobbies, Arts & Crafts/Modern Living Building. Doors open Friday, July 27, 5 p.m.–8 p.m.; Saturday, July 28, 8 a.m.–5 p.m. Features: Technical and non-technical programs, WAS card check, VE exams, flea market. Advance tickets $7, $9 at the door. Flea market tables $10 in advance, $15 at the door (if available). Electrical hookup $5. Talk-In on 146.82. Additional info and registration forms are available on the CORA Web site *[www.geocities.com/heartland/7332]*. Address other inquiries to *Ham Holiday 2001, P.O. Box 850771, Yukon OK 73085-0771; or E-mail [corahams@swbell.net]*.

JULY 28

CINCINNATI, OH The 4th Annual OH-KY-IN Amateur Radio Society Hamfest will be held July 28, 7 a.m.–1 p.m. at Diamond Oaks Career Development Campus, 6375 Harrison Ave., Cincinnati OH. This facility is located just east of I-275 and I-74. Take I-74 to the Rybolt Rd./Harrison Ave. exit (Exit #11). Go east on Harrison Ave. Diamond Oaks is located on the right (south side) of Harrison Ave., less than one mile from the I-74 exit. Special seminars, transmitter hunts, indoor vendors, outdoor flea market — first space free with admission ticket, additional spaces $3 each. VE exams at 8 a.m., walk-ins accepted. Free parking; handicapped parking available. Talk-In on 146.670(-) and 146.925(-) rptrs. Advance tickets $5, $6 at the gate. Age 12 and under admitted free. Indoor vendor tables (6-ft. with free electric) $10 each. Contact *Lynn Ernst WD8JAW, 10650 Aspen Place, Union KY 41091-7665, tel. (859) 657-6161; E-mail [wd8jaw@arrl.net]*. Web site at *[www.qsl.net/k8sch]*.

JULY 28

LINCOLN, ME The amateur radio community and the Bagley ARC of North Central Maine will be holding a hamfest, rain or shine, on July 28th, at the Ella Burr School in Lincoln ME. This is the club's 11th annual hamfest. VE exams will be held in the school complex. For more information contact *Hamfest Committee Chairman David Baker at (207) 794-3398.*

AUG 5

BERRYVILLE, VA Shenandoah Valley ARC will host their hamfest at Clarke County (Ruritan) Fairgrounds in Berryville VA starting at 6 a.m. on August 5th. Take I-81 at (Winchester) Exit 315 to Rte. 7 East (9 miles), bear right onto business Rte. 7 just before the traffic light. Fairgrounds on the left; OR Intersection of Rte. 340 and Rte. 7 in Berryville, go west approx. 2 miles. Fairgrounds on the right. ARRL VE exams at 1 p.m. Ruritan barbecue chicken dinners. Talk-in on 146.82. Admission $5, tables $12–$20. Contact *Brian Mawhinney WB3FUM, 2432-69 Berryville Pike, Winchester VA; (540) 665-0761*. E-mail *[WB3FUM@arrl.net;* Web site *[http://www.Vvalley.com/svarc]*.

AUGUST 11

HUNTINGTON, WV Amateur radio and computer hobbyists from all over the mid-west will be in Huntington WV on Saturday, August 11th, for a giant hamfest and computer show at the Veterans Memorial Field House, 2590 Fifth Ave., 8:30 a.m.–2 p.m. The event is being sponsored by the Tri-State ARA. Tables paid for by July 31st are $8 each; $12 at the door (if still available). Call *Ezra Taylor N8KTA, (304) 429-1667*. VE exams at the Field House; be there by 10:00 a.m. for registration. All examination elements, written and Morse Code, where applicable, will be offered for all classes of amateur radio licenses. A fee of $10 will be charged per test. Pre-registration is not necessary but applicants must present two forms of acceptable identification, including one picture ID. Bring the original of any ham license currently held, and any Certificate of Successful Completion of Examination (CSCE) to claim credit from a previous exam. *Garry Ritchie W8OI*, leader of the TARA VE team, may be contacted at *(304) 733-1300*, for further details.

AUGUST 12

PEOTONE, IL The Hamfesters Radio Club Hamfest, featuring amateur radio, computers, and electronics, will be held at Will County Fairgrounds in Peotone IL. Exhibits open at 8 a.m. in a fully air-conditioned building. Flea market open 6 a.m.–3 p.m. No additional charge for flea market space. Set up Saturday, August 11th, 1 p.m.–11 p.m. Advance tickets $5 w/double stub, $6 at the gate w/single stub. Children under 12 free. For advance tickets (SASE and check by July 25th), and info, contact *Robert Nelson WB9WFR, 1720 Vollmer Rd., Flossmoor IL 60422; tel. (708) 756-7984*, or E-mail *[WB9WFR@aol.com]*. Talk-in on 146.52 simplex and 146.64(-107.2) STARS rptr.

AUG 18–19

HUNTSVILLE, AL The Huntsville Hamfest and Alabama ARRL Section Convention will be held Saturday and Sunday, August 18th and 19th, at the Von Braun Center, 700 Monroe St., Huntsville AL. Admission is $6, under 12 free. Doors open both days at 9 a.m. VE exams will be held both days at 10 a.m. Forums include ARRL, MARS, Skywarn, QRP and more. Convenient parking. Giant dealer/manufacturer show, huge flea market, E-Z drive-in vendor unloading, DX banquet and more. Friday and Saturday night hospitality rooms at the Huntsville Hilton. Talk-in on 146.94(-), call K4BFT. For special hamfest rates at the Huntsville Hilton, call *(256) 533-1400*. Other contacts: Dealer show, (256) 536-3904; flea market (256) 883-2760; Forums *(256) 539-8950;* DX banquet *(256) 721-5996*. For general info call *(256) 880-8004*. Visit the Web site at *[www.hamfest.org]*.

AUG 25

LaPORTE IN The LaPorte ARC will host the LPARC Summer Hamfest Saturday, August 25th, at LaPorte County Fairgrounds, State Road 2 west of LaPorte, 7 a.m.–1 p.m. Admission $5, tables $10, outdoor tailgating $2. Talk-in on 146.52 and 146.61(-) PL 131.8. For more info contact *Neil Straub WZ9N, P.O. Box 30, LaPorte IN 46352; tel. (219) 324-7525*. E-mail *[nstraub@niia.net]*. The Club Web site is at *[www.geocities.com/K9JSI]*.

SPECIAL EVENTS, ETC.

JUNE 30–JULY 2

DeSMET, SD The Huron ARC, and the Lake Area Radio Klub, will host a special events station to celebrate the 30th Anniversary of the "Little House on the Prairie" Pageant. They will be on the air 1600 UTC June 30–0200 UTC July 2. Frequencies: 7.265, 14.265, 21.365, 28.465 and 50.165. To get a certificate or a QSL card, write to Huron ARC, P.O. Box 205, Huron SD 57350 USA; or Bill Kerker [Wa0tdk@arrl.net]. Tel. (605) 352-1577.

JULY 20–22

IRVING, TX Seven members of The Jim Smith Society will operate station W9JSS at the 31st annual Jim Smith convention, July 20, 21 and 22, in Irving TX. The society has about 225 FCC licensed members. Contact W9JSS and receive a unique QSL card — one name with seven different callsigns. Try 14.280, 21.380 or 28.380 +/- QRM, 1530Z–1730Z all three days. Requests for a QSO on other bands, or other times, can be sent to *[JimWB9UKK@aol.com]*. For more info about The Jim Smith Society, check the Web site at *[www.jimsmith2.org]*.

JULY 21

OGDENSBURG, NY The Ogdensburg ARC K2RUK, will sponsor a special event station Saturday, July 21st, to celebrate the maiden voyage of the USCGC Maple WLB-207 to Sitka Alaska, and its visit to Ogdensburg NY (the home port for 17 years of its namesake USCGC Maple 234). The event will start at 1800Z and end at 2400Z. Frequencies: 7.240 and 14.240 MHz ± QRM, to run simultaneously. For a certificate, send a 9 x 12 SASE to *Walt Brady N2YMY, 17 Birch Hts., Edwards NY 13635 USA*.

AUG 18–20

42nd ANNUAL NEW JERSEY QSO PARTY The Englewood ARA, Inc. invites all amateurs the world over to take part in their 42nd Annual New Jersey QSO Party. Rules: (1) The time of the contest is 2000 UTC Saturday, August 18th–0700 UTC Sunday, August 19th, and 1300 UTC Sunday, August 19th–0200 UTC Monday, August 20th. (2) Phone and CW are considered the same contest. A station may be contacted once on each band — phone and CW are considered separate bands. CW contacts may not be made in phone band segments. New Jersey stations may work other New Jersey stations. (3) General call is "CQ New Jersey" or "CQ NJ." New Jersey stations are requested to identify themselves by signing "De NJ" on CW and "New Jersey calling" on phone. Suggested frequencies are 1810, 3535, 3950, 7035, 7235, 14035, 14285, 21100, 21355, 28100, 28400, 50-50.5, and 144-146. Suggest phone activity on the even hours; 15/10 meters on the odd hours [1500–2100 UTC]; 160 meters at 0500 UTC. (4) Exchange consists of QSO number and QTH (state/province or country). New Jersey stations will send county for their QTH. (5) Scoring: Out-of-state stations multiply number of complete contacts with New Jersey stations times 3 points per QSO times the number of New Jersey counties worked (maximum of 21). New Jersey stations multiply number of complete contacts times 3 points per QSO times the multiplier. The multiplier is the sum of the number of states (other than NJ), Canadian provinces, and NJ counties worked. Maximum is 49 + 13 + 21 = 83. (6) Certificates will be awarded to the first place station in each New Jersey county, state, province, and country. In addition, a second place certificate will be awarded when four or more logs are received. A total of two plaques have been donated by the ARRL Section Managers for NNJ and SNJ to the highest scouring single operator station residing in each of their sections. (7) Logs must show the UTC date and time, QSO exchange, band, and emission, and be received no later than September 15th, 2001. The first contact for each claimed multiplier must be indicated and numbered, and a check list of contacts and multipliers should be included. Multi-operator stations should be noted and calls of participating operators listed. Logs and comments should be sent to *Englewood*

Continued on page 58

Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083-5640

Hams in Space

During the 1970s, the focus at NASA was on moon missions and Skylab. One of the Skylab astronauts, a ham, thought it would be great to take a ham transceiver along into space. NASA thought otherwise. It wasn't until the early days of the Shuttle program that this astronaut, Owen Garriott W5LFL, would get his chance.

On November 28, 1983, the Space Shuttle *Columbia* went to orbit with the first manned amateur radio station, W5LFL. The radio was a specially modified 4.5 watt Motorola MX-300 2-meter transceiver built by the Motorola Amateur Radio Club in Florida. Volunteer Lockheed employees crafted a directional ring radiator antenna that could be fitted inside specific shuttle windows. There were a number of battery packs for the radio, cables, a headset, and a small tape recorder to complete the station.

During the 10-day mission, Owen found time for almost five hours of ham activity. There were 350 verified two-way contacts and over 10,000 SWL (Short Wave Listener) reports from 23 countries. It was an exciting and highly successful debut for hams in space. The SAREX (Shuttle Amateur Radio EXperiment) group continued to work with NASA and individual astronauts for over two dozen ham-in-space missions during the next 16 years. While contacts with schools were the primary goal, an increasing number of hams around the world managed to make random contacts with the astronaut hams.

While two meter FM voice operations were very popular, additional systems were tried. Specially configured AX.25, 1200-baud packet provided a mode that allowed an unmanned system on the shuttle to establish verified two-way contacts with ground stations. Other experiments included SSTV (Slow-Scan TeleVision) and FSTV (Fast-Scan TeleVision). The SSTV was very popular and easy to receive on the ground since it only required normal audio bandwidth via the 2-meter HT. The FSTV was more of a closed test with predetermined stations that sent video to the shuttle using AM TV in the 70-cm ham band.

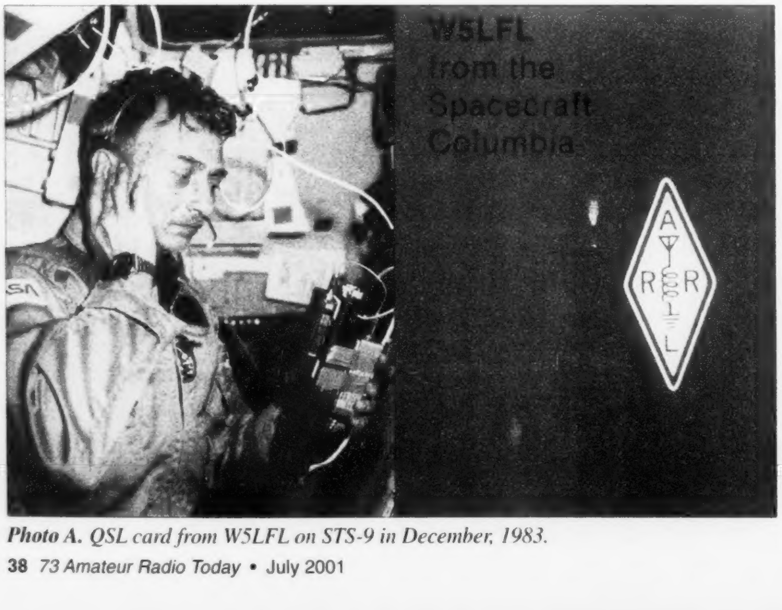


Photo A. QSL card from W5LFL on STS-9 in December, 1983.

Next stop — MIR

When the Soviet Union launched the first component of the MIR Space Station on February 19, 1986, no one knew that this five-year project would extend into 15, and that ham radio would be on board within two years, in a big way. MIR was intentionally brought back to earth on March 23, 2001. The fiery reentry marked the end of a highly successful mission in space by the Soviet Union and Russia.

While the ion trail left by MIR may have provided some meteor- scatter-like propagation, it also represented the end of a lot of ham gear. Miles Mann WF1F of MAREX-NA (Manned Amateur Radio Experiment, North American Division) listed the equipment that was onboard at the end on his Web page [http://www.marex-na.org]: ICOM 228H transceiver, ICOM 70-cm repeater, Kenwood TM-733 dual-band FM transceiver, Kantronics KPC-9612 packet TNC (Terminal Node Controller), PacCom TNC, and the popular SSTV (Slow Scan TeleVision) system.

While ham communications with the Shuttle were limited to short-duration flights, operations with MIR were almost continuous. When a new crew of cosmonauts (and sometimes astronauts) went up to MIR for their tour of duty, activity via the ham gear would stop or slow down for a while. Inevitably though, after a few days or weeks, the new MIR residents would look to the ham gear for live leisure conversations with amateurs on earth. When crew members were not available for voice operations, the packet system, the 70-cm repeater, or the automatic SSTV equipment would be on the air.

And now for ARISS

The ARISS (Amateur Radio on the International Space Station) program represents a logical extension of Shuttle and MIR ham activities. Partner countries include groups from the USA, Russia, Japan, Belgium, France, Germany, Italy, Portugal, and Canada. ARISS has two principal goals: to provide school contacts from Space Station Alpha, and to promote general amateur-radio operation from space.

Ham activities in early 2001 included school contacts, scheduled family contacts for the astronauts, and a few random ham QSOs. Later in the spring, the packet system was activated. Unfortunately the TNC's internal battery had given out and all of the packet settings had defaulted to their "factory" setting. This meant that the system was identifying itself as NOCALL, but the digipeat function was on. Rather than turn the system off till the laptop that was loaded with the appropriate TNC settings could be repaired, it was decided to leave the packet system on-line. This delighted those of us on the ground who wanted to experiment with the gear, and perhaps use it for short packet contacts with others within the coverage footprint.

There are only a few frequencies to remember for 2-meter ARISS activity: 144.49 MHz voice uplink, 145.99 MHz packet uplink, and 145.80 MHz for all downlinks. The hand-held Ericsson M-PA series transceiver is capable of operations anywhere within the range 144 to 146 MHz, but the noted frequencies are those used for general ham contacts. If you hear ISS astronauts on other frequencies, they are either participating in school contacts or personal communications. Try another pass if you want a contact, or monitor the 145.80 MHz downlink in case they finish with their scheduled activity and want to make a few general QSOs while still over your area.

The USA voice callsign is NA1SS. Russian callsigns include RS0ISS or RZ3DZR for voice, and when a laptop is available to get the TNC straightened out, the packet mailbox call will be RZ3DZR-1. Keyboard packet operations will use the callsign RZ3DZR. An excellent description of the complete ham radio system on the space station can be found at the ARISS Web page: [http://ariss.gsfc.nasa].

The radio system is located in the Russian Service Module — hence the predominance of Russian callsigns. The antenna is a special multiband unit that is clamped to an EVA (Extra Vehicular Activity) handhold on the outside of the Service Module. Signals are usually very good from this arrangement.

It doesn't take a lot of power to make contact with ARISS, but competition from other hams is usually the limiting factor.

Continued on page 58

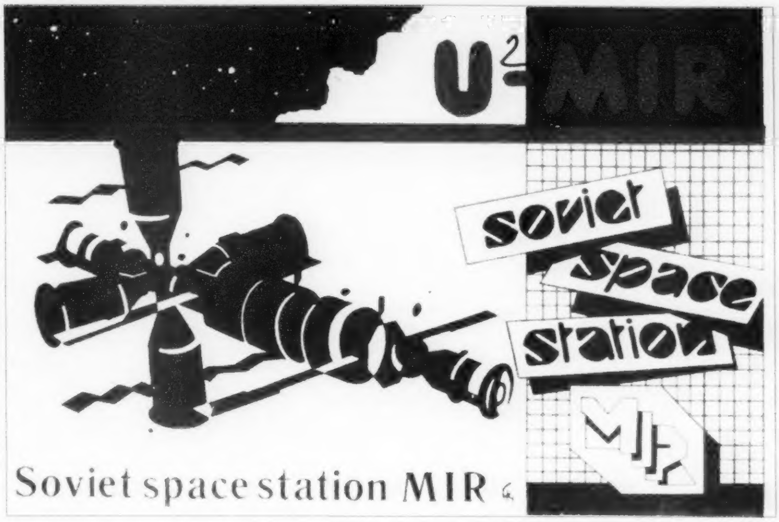


Photo B. *QSL card from U2MIR on MIR in November, 1988.*

N5VFF-1>DM79, NOCALL* <UI>:N9AB - hi andy, here brian
WD4OZN>EM55, NOCALL* <UI R>:whats ur qth andy
W5ACM-2>EL29EQ,NOCALL* <UI R>:hi brian!
K5PK>EM96TD, NOCALL* <UI>:
N9AB>CQ, NOCALL* <UI>:qTH EN52xg
KD4RDB>APRS, NOCALL* <UI>:
W5ACM-2>EL29EQ, NOCALL* <UI R>:
K5PK>EM96TD, NOCALL* <UI>:
W5ACM-2>EL29EQ, NOCALL* <UI R>:hi k5pk
K5PK>EM96TD, NOCALL* <UI>:Hello ACM
N5UXQ>CQ, NOCALL* <UI R>:de N5UXQ, FM17ho, from Central VA
W5ACM-2>EL29EQ, NOCALL* <UI R>:Andy hr
K5PK>EM96TD, NOCALL* <UI>:Steve hr
W5ACM-2>EL29EQ, NOCALL* <UI R>:fb

Table 1. *Example of early packet operation via NOCALL in space on April 14, 2001.*

Photo C. *At W5ACM the Palm VII plots the orbits, while the Poqet PC is used as a terminal with the Kenwood's internal packet TNC for ARISS communications NOW.*

Jack Heller KB7NO
P.O. Box 1792
Carson City NV 89702-1792
[jheller@sierra.net]

More New Stuff

Here's what's new. I talk to a lot of hams with the multimode controllers sitting around, and they are straining to get modern "bells and whistles"-style software to run on their old computers such as the one I am using and older.

Most of my ham friends, and that includes you readers, realize that I use some old, clunky computers. I have one in the house that is a bit faster, but for the *real* work, I use this 120 MHz CPU with 32Mb RAM. A few years back that would have been considered blazing fast. Now ... Well, recently, one of my buddies, who enjoys heckling, asked if I needed any software upgrades for my Commodore 64. Hmmpf.

All kidding aside, there is a reason for using this machine. If it will run on this, you can be pretty well assured that it will run on that new whiz-bang computer down at the bargain center with the giga-whatevers inside.

Since I fall, at least partly, into that same category, I discovered a welcome answer. Though I have a lot of stuff that works pretty well, the new packages are often geared for the high-horsepower processing units.

The solution

The folks at Creative Services Software ([www.cssincorp.com] in *The Chart*), have worked out new packages that take advantage of the older controllers such as my PK-232MBX and the Kantronics and MFJ multimode units that will have you thinking you are flying a super-computer.

The packages run under the familiar Windows platforms, have interfacing logging modules, and also run PSK31 all in the same boot-up. That is, if you do it right, you can boot the programs and run the course from RTTY, Pactor, CW, and other modes that make your old controller come alive to a very well done PSK31 module with a few clicks and a switch. I will describe in a minute.

The price of the software may just be the reasonable alternative to buying new gear and starting from scratch with a new computer. I don't know about your computer, but I would hate to think of the hours it would take to set up a new computer to do what this one does (that is another story).

The real story is that I have been working with a pre-release version of this software for my PK-232MBX and the more I use it, the more I like it. As I said, the PSK31 module is impressive. It does employ the soundcard, as do other programs for this mode, and simply uses the PK-232 MBX for PTT in that mode.

What impressed me was its sensitivity, and ability to lock on to just about any signal in the tuning display if I clicked somewhere reasonably close to the signal trace. It has a feature I would have passed off as a novelty once upon a time, but I find the combined waterfall and spectral display a great way to go. I usually prefer the spectral display for determining the strength of a signal and showing the center to click, but I prefer the waterfall to watch for a new signal to show up that might be a new station calling CQ.

The PKTerm software displays one above the other as you can see in the accompanying screenshot. You get the best of both worlds and I like that. The combined display only took a few minutes in action to move from sense of novelty to full-blown necessity.

The macros took me a bit to get used to. Fortunately, the option to invoke macros with keystrokes is there, as well as "transmit" and "receive." Or you can go at it via

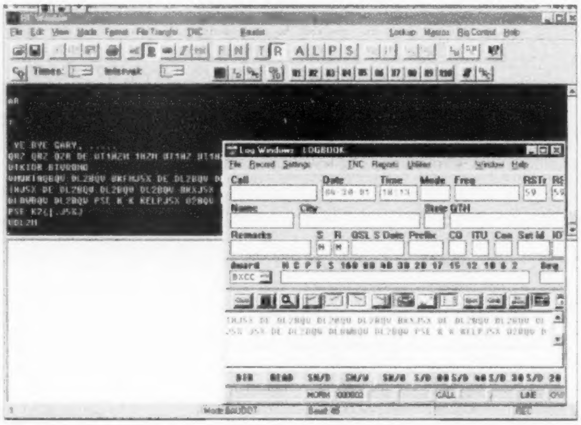

File Edit View Mode Format File Transfer TNC
Lookup Macros Rig Control Help
Times:
Interval:
Log Windows LOGBOOK
File Record Settings TNC Reports Utilities Window Help
Call
Date
Time
Mode
Freq
RSTr
Name
City
State
QTH
Remarks
S
R
QSL S Date
Prefix
CQ
ITU
Con
Sat Id
Award
BXCC
Seq

Fig. 1. Screenshot 1 — This is the log program reduced to fit over the communications program. You can see the received text is displayed in both windows. If you have a larger monitor, these can be side by side. Once you have established contact, you can maximize the Log Windows panel and simply carry on from there, sending and receiving text and doing the "overs" with the function keys. The Log program has rig control as well as rotor control, allowing you to automate your station to whatever extent you desire. Rig control speeds up the action as the mode and frequency are automatically inserted along with the time and date which is supplied by the computer. If you are using an older controller that cannot simultaneously access the packet cluster and the HF mode in the controller, the system has provision and instruction to set up AGW packet engine to run from a separate serial port. This shot was taken late in the morning here in the west, and 15 meters was the hot band of the day. The received sigs were barely moving the S-meter and yet, as you can see, the RTTY print was excellent.

the slower and more deliberate mode by clicking buttons and menus.

Speaking of additional modes. Well, I shouldn't say it that way. The multimode controllers all do packet. However, the really old stuff, such as the PK-232MBX, cannot simultaneously run packet, as to a DX cluster, while working one of the other modes such as RTTY. There is a plan, described in the Help Files, to use the AGW software through a separate serial port to accomplish this slick trick. So here is another place to save a few bucks. In my case, I need to add serial ports and the whole operation will dovetail while eliminating the need to spring for a later controller.

The Help File is well written and contains about all you need to get over any of the humps for setup and operation. I downloaded the optional Operating Manual in Adobe Acrobat format. I find it is less frustrating to have a handful of hard copy than to guess at the jargon some of the documentation folks put in the Help Files. That is just a rule that works for me, not a criticism of these Help Files; it is an automatic procedure. However, you may wish to skip that part when I tell you the Manual printed out to nearly a hundred pages. It is, by certain standards (mine), recommended reading.

Easy setup

On to success. This really is not difficult software to set up. In the case of the PK-232MBX, I am always a bit hesitant with new software because there are so many parameters that one can mess with and get wrong. Well, my fears were for naught; the software has its own set of parameters that just plain work. That means, install software and follow the directions, such as, and mostly limited to, start the program.

You will have to set the Comm port and possibly the baud rate plus enter your callsign, and if you are to choose to operate AMTOR there is a selcal requirement. The automated settings are those other 100+ incidentals you just don't need to bother with. Though it is possible to tamper with them if you insist, but I did not find it necessary.

Once you have the program installed, you can start working the modes inherent to your controller, plus you will have the ability to operate PSK31 with the same software. The modes available from the controller work as well as, or better than, I have ever seen with any other software. The RTTY is very sensitive, plus it toggles transmit/receive quickly. I was copying and working stations that were not moving the S-meter with no additional filtering help in both RTTY and Pactor.

Now, I have to confess to a few things I did to make this setup a bit easier to handle. I realized I was going to have a conflict of hookups and would have to do some cable switching all too often if I didn't get serious about this lash-up. I made a little switchbox, which is a breakout box in the cable from the rig to the controller.

That way I can, with the flip of a switch, redirect the sound going to and from the rig to the controller and redirect it to the soundcard when I want to work PSK31. That seemed like a reasonable project, simple. But of course I saw another possibility, which led to a few more jacks allowing a route through the DSP 599zx. All this can be left hooked up or rearranged for different test purposes.

The switching was an excellent idea. I will never regret that part of the project. Strangely, other than the time spent experimenting with and optimizing the 599zx that part was not really a necessity thus far. The copy, as I said, has been phenomenal with no extra help. So take that as a plus for the caliber of the software.

I discovered I have excellent results with this software printing very weak signal RTTY as well as other modes. Therefore, there has not been a real need for additional filtering. Now, this is surprising, since all the time I have been using this software, even in the controller modes, I have left the filter wide open on the rig. And that has been wide as in the 3.0 kHz that works so well with the DSP soundcard programs I have been accustomed to using.

Continued on page 42

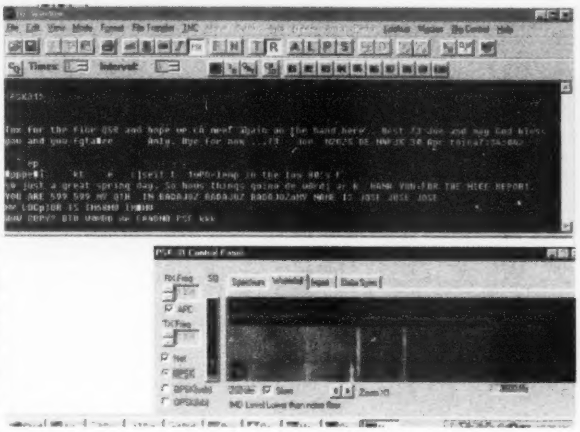
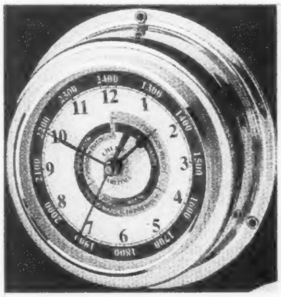


Fig. 2. *Screenshot 2 — This is the program in the PSK31 mode. The PSK31 tuning module can be moved wherever works for you. In this case, I left it fully displayed so you could see all the buttons. This shot was taken within 15 minutes of the RTTY-Log screenshot, also on 15 meters. For a few minutes, there were about twice as many signals tracing down the waterfall. The EA4 signal is the trace that is no longer transmitting (about a third of it left on the waterfall display) below the dotted line just below the "Data" tab. The other two signals to its right not only are visible in the waterfall, but also in the spectral display directly above the waterfall. These were also weak signals that did little more than tease the S-meter. Two most impressive features are the ease of tuning and the remarkable sensitivity to received text. Signals have to be just about buried beneath the noise level to avoid readable print.*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Source for:	Web address (URL):
Mix W Soundcard program for PSK31, RTTY, new modes, MTTY, FSK31, more	http://tav.kiev.ua/~nick/my_ham_soft.htm http://users.nais.com/~jaffejim/mixwpage.htm
FREE MMHam site — MMTTY — MMSSTV	www.geocities.com/mmhamsoft/
FREE VK7AAB — SSTV-PAL — PSK-PAL	http://users.origin.net.au/~crac/
Much ham info w/SSTV downloads	www.conknet.com/~kb1hj/index.htm
TrueTTY — Sound card RTTY w/ PSK31	www.dxsoft.com/mitrtty.htm
Pasokon SSTV programs & hardware	www.ultranet.com/~sstv/lite.html
PSK31 — Free — and much PSK info	http://aintel.bi.ehu.es/psk31.html
Interface for digital - rigs to computers	www.westmountainradio.com/RIGblaster.htm
Soundcard interface info — includes Alinco	www.packetradio.com/psk31.htm
Interface info for DIY digital hams	www.qsl.net/wm2u/interface.html
WinWarbler info and free download	www.qsl.net/winwarbler/
MFSK-related tech info — how it works	www.qsl.net/zl1bpu/
Throb — New — lots of info	www.lsear.freeserve.co.uk/ www.btinternet.com/~g3vfp/
Download Logger, also Zakanaka	http://www.qsl.net/kc4elo/
PSKGNR — Front end for PSK31	www.al-williams.com/wd5gnr/pskgnr.htm
Digipan — PSK31 — easy to use	http://members.home.com/hteller/digipan/
TAPR — Lots of info	www.tapr.org
TNC to radio wiring help	http://freeweb.pdq.net/medcalf/ztx/
ChromaPIX and ChromaSound DSP software	www.siliconpixels.com
Creative Services S/W Multimode w/PSK	http://www.cssincorp.com/products.htm
Timewave DSP & AEA (prev.) products	www.timewave.com
Auto tuner and other kits	www.ldgelectronics.com
XPWare — TNC software with sample DL	www.goodnet.com/~gjohnson/
RCKRtty Windows program with free DL	http://www.rckrtty.de/
HF serial modem plans & RTTY & Pactor	http://home.att.net/~k7szl/
SV2AGW free Win95 programs	www.raag.org/index1.htm
Source for BayPac BP-2M & APRS	www.tigertronics.com/
Int'l Visual Communications Assn. — nonprofit org. dedicated to SSTV	www mindspring.com/~sstv/
Hellschreiber & MT63 & MFSK16 (Stream)	http://iz8bly.sysonline.it
HamScope — multimode w/ MFSK16	http://users.mesatop.com/~ghansen/
YPLog shareware log — rig control — free demo	www.nucleus.com/~field/

Table 1. *The Infamous Chart ... updated monthly.*

THE DIGITAL PORT

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There is more to this software than simply printing to the monitor and being heard. Speaking of being heard, I have gotten excellent reports on quality and readability, which I had neglected to mention earlier.

But the next phase of the program was probably the most impressive. There is a logging program dubbed Log Windows you must download from the same site. It has at least one feature that I feel is the result of inspired genius.

As you may recall, this station is monitor-challenged, with the smallest monitor commonly available for the wannabe computerist (13" diagonal). This leaves me at odds when it comes to displaying panels side by side. They overlap and become nearly unreadable in most instances. The result is that I must frequently click the hidden panel up from the task bar and see only a part of the action at a time.

This would not be so bad, except that during the fray of keeping a conversation going (I am the resident world-class ragchewer and must uphold that image) and inserting QTH in a logging program along with other pertinent and indispensable information, those clicks to the task bar get more frequent and very distracting.

Here is the best solution I have seen for that dilemma. Log Windows is engineered to work hand-in-hand with PKTerm or with the software by the same folks for one of the other controllers, and you will find it is only necessary to display the logging program while you are in contact. Why? The logging software also has a receiving pane and a composing area and you can do it all from the Log Windows panel once the contact is established. A genuine cure for my problem arrived at last.

While I was doing this evaluation, there came a message of an update for entry into the Log Windows from a pop-up in the Communications panel. With the version in front of me, it is necessary to highlight the other station's callsign and operator name and do a few calisthenics just to get this info into the macro and that still does not put it in the Log Window. This addition will be in the version you will download.

Endless features

Ah, but there is still more. Within this package is contained an excellent rig control that works. Log Windows has more goodies than you can shake a stick at. There is an up-to-the-minute listing of rigs that you can set up to control through your serial port and, in the process, automatically record mode and frequency in your log book. It works.

A little more? Yup, there is also a controller for your computer-controlled antenna rotator. The art of working DX has become a push-button performance with all the automation available these days. And you can get it all in one integrated package.

And perhaps your interests are just a bit broader. They also have a Wefax program to work with your controller. Pretty fancy stuff. As I was reading through the documentation on that, it was telling about automating to a point that it would record specific weather images at preset times and you don't need to be there; just simply have the equipment turned on. Beats watching TV for the weather pics.

Now, the credibility factor should be discussed. You may question just how slow-moving can your computer be and still run all this fancy stuff. I was discussing this with Rick W4PC, the developer, and he tells me of running the PKTerm on a 486DX/2 50 MHz

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HOMING IN

Radio Direction Finding

Joe Moell P.E. K0OV
P. O. Box 2508
Fullerton CA 92837
[Homingin@aol.com]
[http://www.homingin.com]

Secrets of the RDF Whirligig

America's Cup sailors always want faster boats. NASCAR drivers always want faster cars. Fighter pilots always want faster planes. Their goal is to win the race or the dogfight, and it takes the fastest and most "user-friendly" equipment to do that. The same is true in hidden transmitter hunting, which we hams call T-hunting or foxhunting.

Everyone knows that the fastest mobile T-hunting setups use Doppler units, right? Well, sometimes. On the plus side, a Doppler takes bearings hundreds of times every second and displays them instantly, even on very short signal bursts. VHF/UHF Doppler installations are inconspicuous, easy to use, have no moving parts, and interface readily with a computerized mapping and navigation system.

I use my mobile Doppler on two meter T-hunts when it's the right tool. But sometimes it isn't. A Doppler outputs a single bearing indication for each rotation of its array, no matter how many direct and reflected signal components are present. So in an area of high signal reflections (multipath), the display often bounces around aimlessly.

T-hunters here in southern California and elsewhere prefer rotating gain antennas such as beams and quads in these situations. Their receiver S-meter shows the azimuth of each incoming signal peak. That makes it easier to determine (or should I say guess?) which one is direct and which others are reflected. A beam setup is more sensitive than a Doppler, giving greater range. It works better on horizontally polarized signals, too.

Some T-hunters have taken the idea of separating the direct and reflected signals a step further by making polar plotters to show signal amplitude versus direction on a cathode-ray tube (CRT) or computer screen. The operator "eyeball averages" the fluctuations resulting from vehicle motion. A large repeatable lobe identifies the most likely direct bearing to the T. Reflections and noise in other directions show up as a jumble of noncorrelated traces after several rotations of the mast. If two or more keyed-down transmitters in different directions are on the frequency simultaneously (such as a jammer and the station being jammed), a polar display can resolve bearings for each of them. Try that with a Doppler!

One more plus for polar displays: The multiple overlaid sweeps on a CRT will give accurate bearings of single-sideband stations and pulsed noise sources. Dopplers, on the other hand, can't do this because they require carrier-type signals. They aren't designed to track emissions with large amplitude variations.

For good eyeball averaging, the CRT must display several rotations or sweeps of the RDF antenna at a time. An ordinary oscilloscope won't do. You need a storage-type oscilloscope or a high-persistence CRT like the ones in radar sets of the pre-computer era.

Notes from Nottingham

Last month, I began describing the polar plotting system used by Dave Bullock G6UWO and John Wood G0PSI. They have a motorized 5-element J-beam atop their sedan. A shaft encoder (**Photo A**) and digital logic generates beam azimuth data in sine and cosine form. When combined with S-meter values from the receiver, the CRT display shows incoming signal level in all directions simultaneously. As they drive the roads around Nottingham, England, Dave and John use the flickering lobes of the display to determine which is the most likely

Continued on page 44

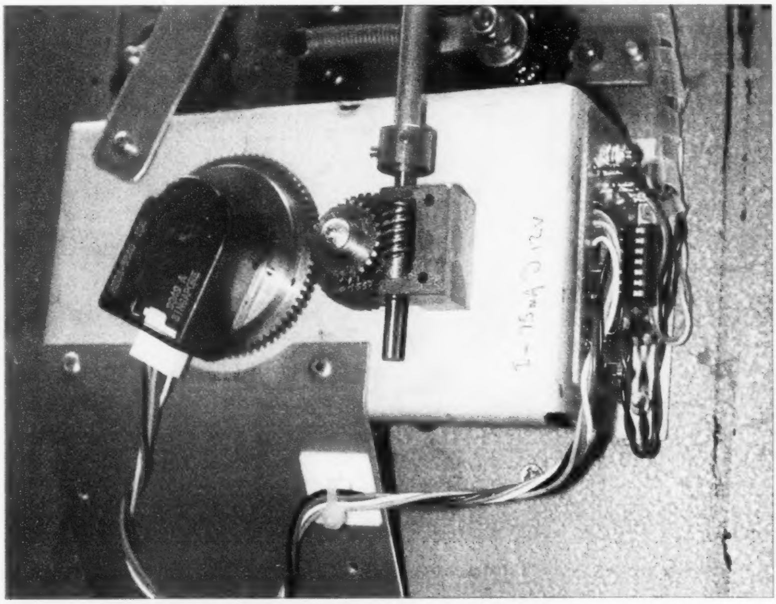

Photo A. *The Hewlett-Packard shaft encoder and gearing system provides azimuth data. (Photo by Dave Bullock G6UWO)*

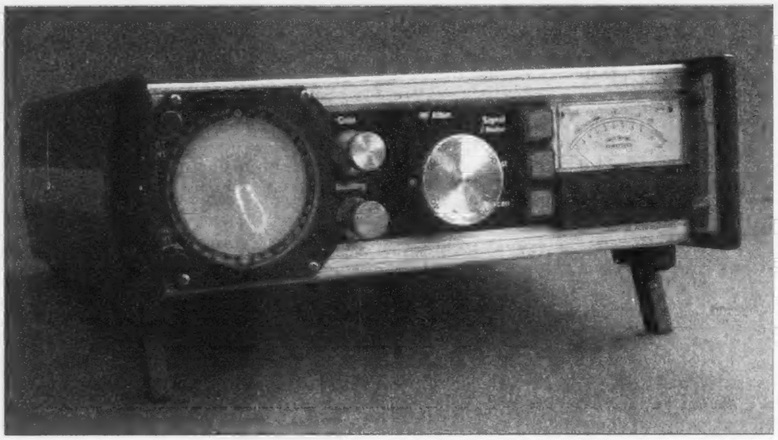

Photo B. Dave and John's final unit (for now) is in a recycled instrument case that fits easily on the dashboard. (Photo by Dave Bullock G6UWO)

HOMING IN

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signal source direction and which other lobes represent multipath.

"Having hunted with the system for two full years now, I can report that it is almost unbeatable when pitched against both Dopplers and normal manually turned beams," Dave says proudly. The primary indication of signal strength comes from the S-meter output of G6UWO's Pye M2000 receiver. This set is unusual because its meter circuit output changes about one volt for each 20 dB change in signal strength. This gives the system a very wide dynamic range.

"We get a good indication of signal direction from a rock-crushing 6 feet away from the transmitter to an extremely weak signal in the noise," Dave continues. "We also developed a noise detection add-on that improves the sensitivity by a further 20 dB. The new circuit gives a full-scale indication with as little as 0.5 dB of quieting on the unsquelched FM background noise."

Figs. 2 and **3** in last month's "Homing In" are the schematic and board layout for the noise detector. G6UWO explains it this way: "Based on an 'absolute value' full wave rectifier, this circuit has perfect linearity and responds to the smallest of input voltages, making it ideal for detecting the slightest changes in quieting of the FM noise."

Dave's prototype polar plotter was a surplus video display unit with medium CRT persistence. He modified it by making his own X and Y deflection amplifiers from L165 ICs to drive the horizontal and vertical deflection coils, which he rewound with more turns of finer wire for greater screen deflection. He had to substitute a toroidal ring inductor for the horizontal coil in the high voltage DC-to-DC converter to keep it working properly.

The prototype proved the advantages of a polar RDF display, but Dave and John weren't satisfied. "It worked well," G6UWO wrote. "We successfully competed in our county championship for a whole season, winning by a narrow margin. But the display was too large. It had to sit on the floor between my feet and all the wires would get caught in my legs every time I jumped out to investigate possible hiding places.

"From a safety point of view, this was very unsatisfactory," he continued. "Operationally it was a nightmare! The large folding maps on my knee obscured the display and strong sunlight reflected off the screen. Also there was the problem of mentally transferring the angle of detected transmission from the display onto the map. Something had to be done to improve this situation. What we needed was a more compact, user-friendly setup.

"During the summer months, we scoured the radio rallies. John discovered a 2.5-inch-diameter radar display module from a Phantom fighter aircraft in one of the flea fair stalls. For fifty dollars, he snapped the bargain up and then worried if the tube would turn out to be faulty. Of course there were no circuit diagrams and most of the electronics was 'tropicalized' in a thick clear coating of a varnish-like material.

"I stripped the display to find that the power supply ran off 24 volts. It was a self-contained unit that would supply most of the potentials for the CRT. The only extras needed were negative grid bias and 9.7V for the tube heater. The heater was easy with a variable regulator. I used the high-voltage module recycled from an old fluorescent calculator display to give me up to –80 volts for the grid.

"The rest of the electronics was junk, apart from the deflection driver and output transistors that were on the end plate of the module. I decided to build my own deflection amplifiers incorporating these transistors, as I reasoned that they should be matched to the coils. I used a couple of operational amplifiers and tied the output

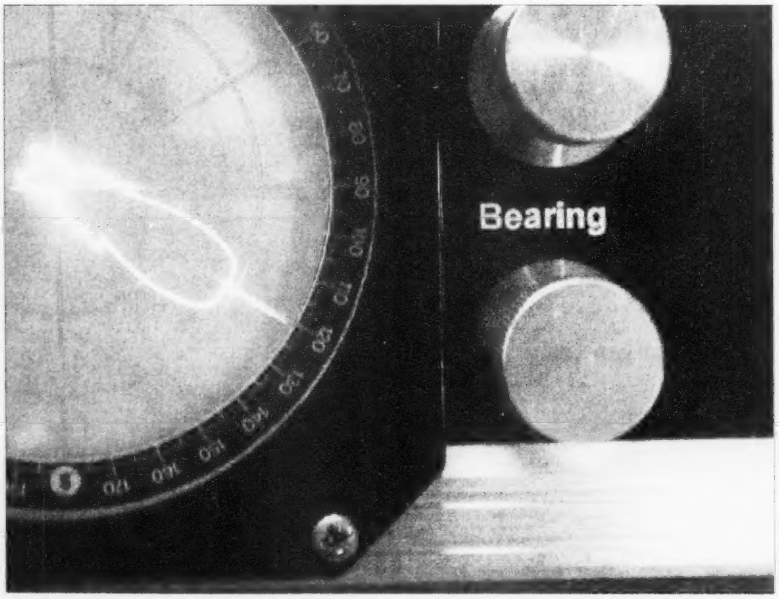

Photo C. Artificial persistence creates a trace with consistent intensity. The sharp point is a marker for precise plotting. (Photo by Dave Bullock G6UWO) transistors into the feedback loop to keep the whole circuit linear.

"I now had the problem of finding a 24-volt source. Our local military surplus depot came to the rescue. By modifying some ex-aircraft 400 Hz inverters that produced -32V from +32V, I was able to get the inverter to produce -12V from a +12V input. Now I had ±12V for my deflection amplifiers and 24V for the HV supply. The whole module could run off the car battery.

"The new scan amplifiers and coils worked extremely well, allowing me to move the trace around the screen at great speed without distortion. But that exposed my next problem. Being a white screen, the phosphor had a very short delay persistence, making the readout look like a tadpole swimming around, rather than a coherent polar plot!"

Photo D. *Transferring bearings from display to map is easy with this wand of light-emitting diodes. (Photo by Dave Bullock G6UWO)*

Constantly refreshing

Dave realized that he needed an "artificial persistence" circuit. He designed it using a dual-port RAM, which has independent input and output ports that point to the same memory locations. The memory is loaded with signal-strength data at the antenna rotation rate, but reads out to the display at a much higher rate. It gives the appearance of a continuous display by refreshing at a rate that is faster than the persistence of vision.

"Whilst I was working on the redesign, I also had a stroke of luck with the antenna position encoder," Dave says. "At work I had a broken graphics plotter come into the

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workshop as scrap. It contained some very nice optical shaft encoders made by Hewlett Packard that had 512 steps per revolution. This was an ideal opportunity to increase the resolution of the display from 208 steps to 512. I decided in the end, as everything else was 8 bit, to make it 256 points.

"I added a mechanical adjuster to turn the encoder with respect to the rotator system. With a signal source directly in front of the vehicle, the adjuster is rotated until the displayed lobe is drawn 'dead ahead' on the CRT. All misalignments in the system are removed in one go with this control, including any skew in the response of the antenna.

"As in the prototype, when the antenna turns, clock pulses from the shaft encoder drive an 8-bit counter that progresses through the RAM input addresses. The same clock pulses are fed to the 'start convert' pin of an A/D converter that digitizes the value of the S-meter voltage at that instant. An 8-bit number appears at the output of the converter, representing the magnitude of the signal at that position, and is stored in one of 256 RAM allocations.

"The antenna rotates continuously, storing data in the memory as it goes. At the 'dead ahead' position, a pulse from a second optical ring on the shaft encoder resets the address counter so that the antenna keeps in synchrony with the counter. I feared that under high-speed travel conditions and the high resolution of the encoder, extra pulses could be generated due to wind pressure on the antenna and slight backlash in the mechanics.

"The clock oscillator provides pulses that advance the output address counter. It steps through the output addresses of the Dual Port RAM and simultaneously, the EPROM address lines. The EPROM is loaded with sine and cosine waveforms, now regenerated with 256 points. The stored S-meter levels in memory are output to the D/A converter that restores them to a varying DC level. This, as before, controls gain of the sine and cosine D/A converters.

"As the clock oscillator runs, a circular timebase is created and signals are displayed on the CRT. The oscillator clocks the output system at a much higher rate than the input system is clocked by the antenna, so the display is that of a continuous plot being updated at the rotational speed of the antenna.

"All the aforementioned problems with wires and maps were eliminated by our miniaturization, and the controls were much easier to access, too. We didn't have any problems with jitter on the display due to slack in the mechanics, and the arbitration logic in the RAM invisibly takes care of any bus clashes."

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PO Box 2, Seaton, Devon EX12 2YS England
Tel & Fax: 44 1297 62 56 90

Even with the high-tech CRT display, Dave and John put an S-meter on the console (**Photo B**). Based on experimentation with the system, they put marks on the meter to indicate approximate "miles downrange" for a transmitter of typical power output. The console also has a switch to select signal strength or noise mode, plus an RF attenuator in 10 dB steps from 0 to 100 dB. It goes between antenna and receiver to prevent overload.

"There is also an 'inch' control to zero the antenna dead ahead for high speed motoring between transmissions," Dave adds. "The Bearing control is another recent improvement. As can be seen on the display in **Photo C**, there is a sharp 'glitch' on the peak of the polar plot on the CRT. This is a pip marker that can be rotated 360 degrees around the display. The navigator moves it to select his best guess at the incoming direction. The pip data also goes via a ribbon cable to a clear-window wand that transfers this bearing to the map via a ring of LEDs (**Photo D**)."

Many thrills of victories

"The system has performed extremely well and we have been able to stay at the top of the Nottingham club's foxhunt championship for the last four seasons," proclaims G6UWO. "Dispensing with paper maps, we have adopted a GPS-based navigation system using a laptop computer. As an effort to make things work even better, we have modified the rotator to make it start and stop in two stages. The slow start should take some of the load off the mechanism as it gets up to speed. When I switch off, the rotator drops back to slow-mo and then autoparks dead ahead."

Does this inspire you to try a polar display in your own mobile T-hunting setup? Check your library for "Homing In" articles on five other such projects, as listed last month. Then decide what's best for your needs. Every system is unique and you probably won't want to copy any of them exactly, but a complete circuit description and schematics for the G6UWO/G0PSI version is available. Although there's no room to publish it all here, I'll mail a paper copy if you send me a self-addressed 9 x12 manila envelope with postage for three ounces (77 cents in the USA).

Happy experimenting! Please send reports and photos of your successful polar

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Steve Nowak KE8YN/0
16717 Hickory St.
Omaha NE 68130
[ke8yn@netzero.net]

Pocket APRS

APRS, the Automatic Position Reporting System invented by Bob Bruninga (WB4APR), is one of the really fun aspects of the hobby. With APRS you graphically display station locations on a map on a computer screen and track moving objects such as cars, satellites, balloons, etc.

While many APRS stations are composed of a desktop PC, a TNC (terminal node controller), and a 2-meter transceiver, much of the equipment has been getting smaller and smaller. There are now many mobile APRS operators, and some stations have become portable by utilizing handie-talkies and laptop computers. Radios such as the Kenwood THD-7A handie-talkie and the TMD-700A mobile rig have built in APRS capability including the TNC as well as an APRS program. Now, if we could only shrink the computer down to a more reasonable size, we'd be all set.

The good news is that we can now do just that. The popular personal digital assistants (PDA) that everyone is using to manage their schedules have given Mike Musick (NØQBF) the platform to develop a truly portable APRS display system. His system, called pocketAPRS, operates under the Palm OS, the operating system developed for the Palm Computing Palm PDA (formerly called the Palm Pilot). This operating system is also used for compatible PDAs such as the Handspring Visor. Mike's approach of using a PDA offers two major advantages. Obviously it makes APRS much more portable when one can carry his computer in his shirt pocket. The other major benefit is that a digital assistant is much cheaper than the cost of a dedicated computer (especially a notebook), so it lowers the overall cost of an APRS station. Naturally there are limitations, but none of any significance. The small size of a shirt-pocket-size system will limit the ability to display details, although one can zoom and scroll to view specific items. The Palm display is only 160 x 160 pixels and measures about two and a half inches square, so resolution is not what you'd see on a 17-inch SVGA monitor. There are also limitations in the pocketAPRS program caused by the basic design of the Palm and Palm OS. PDAs do not utilize hard drive storage or a multitude of inputs the way a desktop computer does, so the program is written for a memory-resident system. On the other hand, this does provide for more efficient operation while costing only 217K worth of memory. The system performance on the digital assistant ends up about the same as one would expect from a 386 computer, which is pretty impressive from a device about the same size as a calculator.

If you have a transceiver and a TNC, you can use your PDA with very little additional effort. Your PDA must be running Palm OS version 3.0 or later. Most of the units currently in use do just that, and upgrades are often available from the manufacturer as downloadable files. You'll need a cable that connects your PDA to your TNC and of course you'll need the pocketAPRS program. The cable has been available from several sources, although some that sold them in the past have gotten out of the cable business. The program is shareware and available for download at the Tucson Amateur Packet Radio (TAPR) FTP site: [ftp://ftp.tapr.org//aprssig/palmstuff/palmaprs/pctaprs.zip]. The current version is v1.14; this version fixes a series of bugs found in previous versions, so make sure that you have the latest update. For a lot of good information on this program, a trip to [http://www.pocketaprs.com] will prove to be time well spent. This site may also have current information or links available on vendors for the required cable. By the way, since this is shareware, good practice dictates that if you try this and like it you pay the $40 registration to Mike Musick. More important (sorry, Mike), the registration fee enables you to save settings between uses, which otherwise must be re-entered at every power up.

From a functional standpoint, pocketAPRS works just like any APRS system. The program is intense enough that using a PDA for APRS will disable almost all other functions until you exit the APRS program, but when I'm playing with my hobby, I don't want anything else to interfere. The APRS function also places a higher demand on batteries, but AAA cells are cheap, so this is something that is more of a "something to watch" than anything else. If you inadvertently run the batteries all the way down, most PDAs will lose whatever is in memory, which can be inconvenient (or worse.) Fortunately, the pocketAPRS program map display includes an on-screen battery monitor to help you keep tabs on battery life.

The PDA can display stations on a map in real time; send, receive, and track messages; and control the TNC. Many of the commands utilize a "one touch" philosophy utilizing the PDA's buttons. Help is readily available for most functions so learning (or remembering) a particular function is virtually painless. If you have a Kenwood TH-D7 or TM-D700A, this comes as close to "plug and play" as ham radio will allow.

Since APRS is graphical in nature, the basic format is to display station locations on a map. There is a fairly wide range of maps available for locations in the United States, and maps for other locations are beginning to become available. Currently, there are over 200 U.S. metropolitan areas available for download. Converting a map to this format requires an Apple Macintosh computer, so mapmakers are somewhat limited. The map detail is pretty impressive considering the size and memory limitations inherent in such a small package. By adding the map for Omaha and the US Interstate system, my total memory consumption

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NEW PRODUCTS

Alinco Announces New North American Distributor

USA Alinco Branch has announced a major change in its distribution structure serving North America. Effective May 3, 2001, Alinco products will have been available to dealers and customer service obtained through Atoc Amateur Distributing of Ohio. The announcement was made by Katsumi "Naky" Nakata, manager of Alinco's North American operations, and Phillip A. Cota, president of Atoc Amateur Distributing.

"We are excited and pleased to announce this change," said Mr. Nakata. "Our new distributor has long and valuable experience in serving the dealer network and they have demonstrated a strong commitment to customer service with their product lines over many years."

Atoc Amateur Distributing will be headed by members of the Cota family, who also manufacture and distribute the Iron Horse and ATOC lines of antenna and radio accessories. The Iron Horse line also includes OEM and aftermarket accessories for large vehicles such as RVs, buses, and trucks. Phil's father, Glenn Cota, is also remembered as the creator and distributor of the Valor radio accessory product line, which the family sold to other interests several years ago.

Phillip A. Cota will lead the new distribution company. "We are proud to become the distributor for Alinco products in North America. Alinco has a well-established catalog of products and a reputation for strength, value, and reliability. Our mid-America location positions us well for attending to the needs of customers and dealers. It's going to be a very strong operation."

Mr. Nakata said that Alinco's corporate function would now concentrate on designing and manufacturing new products from its headquarters in Osaka, Japan. He emphasized that Alinco is a very committed, viable player in the Amateur Radio marketplace. It is also branching into related areas, such as the design and manufacture of high-quality scanning receivers available to the general public as well as to institutional users such as law enforcement and the military. "Having a distributor based in America is good for Alinco, good for the dealers, and most importantly, good for the growing Alinco customer base," he said.

The transition for dealers should be almost seamless, according to Mr. Nakata, as contacts and information will be handed over to the new entity. Evelyn Garrison, a long-time Alinco associate, will continue representing the Alinco line for the new organization. Importantly, all Alinco warranties will remain in force and continue to be honored through their term. In addition, customer support and out-of warranty service will be available through the new operation. Warranty customers should not be concerned, as warranties that expire in that period will be extended to cover the transition period. Details for shipping any radios in need of repair will be announced on the Web at [www.alinco.com]. "Radios already sent to our Torrance, California, address will be transferred to the new facility without fail," said Mr. Nakata.

Mr. Cota added, "We want to assure everyone that our customers will continue to enjoy exciting new products, excellent support, and the fine customer service expected from a quality operation."

Mini-News from CSS

- Creative Services Software has announced that version 3.07.33 of the popular logging program Log Windows has been released. This version supports Kenwood's new TS-2000 (including the Packet Cluster Tuning feature) and the new Yaesu FT-817 QRP rig, among many, many other features.
- CSS continues to work on 32-bit and 64-bit versions of Log Windows, with compatibility with the forthcoming Windows XP a priority.
- Autologging technology, allowing the user to log a contact directly from the TNC program without typing the data directly into the logging program, has been added to CSS's line of TNC programs, which include PacTerm '98, PKTerm '99, and MultiComm Host/Multimode (upcoming).
- CSS is discussing with Larry (Tree) Tyree N6TR the possibility of incorporating both TRLog and Log Windows technology into a next-generation contesting program.

For more information on these or other products, please contact Creative Services Software, 503 West State St., Suite 4, Muscle Shoals, AL 35661; tel. (256) 381-6100; fax (256) 381-6121.

SG-239 Smartuner Antenna Coupler

The SG-239 ushers in a renaissance of HF communications, as it will work with any transceiver to provide long distance communications across borders and continents. By using the SG-239 antenna coupler, anyone can achieve great results with a longwire antenna or a coaxial-fed multiresonant antenna at the window of a condo in a big city or on the roof of a small house.

The unit will work with silent receiver tuning or within the range of 1.5 to 200 watts with a high-power transceiver. It has 170 memory bins, with fast, accurate tuning via independent sensors, including VSWR, phase, magnitude, low impedance, and forward sensing.

For more information, contact SGC, 13737 SE 26th St., Bellevue WA 98005; tel. (425) 746-6310; fax (425) 746-6384.

Rockwell Collins Propagation Software

Rockwell Collins has upgraded its highly successful HF Propagation Resource Manager software to provide customers with the latest in communications technologies. Collins' PropMan 2000 identifies and displays the best channels for an HF communications link in a user-friendly graphical Windows/Windows NT environment. It dramatically improves communications quality and reliability, and is ideal for any HF radio operation.

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Requires Windows 95/98/NT; VGA monitor, 640x480 at 256 colors; 20 Mb hard drive space; CD-ROM drive for install; Internet access; Internet Explorer 4.0 or greater. $99 plus s/h plus tax where applicable.

For further information, contact Rockwell Collins, PropMan Dept. 120-130, 400 Collins Road NE, Cedar Rapids, IA 52498; tel.: (800) 321-2223; fax (319) 295-4777; E-mail: [collins@collins.rockwell.com]; URL: [www.propman2000.com].

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•	All Electronics Corp.	13
•	Am-Com, Inc.	25
16	Astron Corporation	2
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168	Buckmaster Publishing	29
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99	Communication Concepts	19
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By Eric Shalkhausser W9CI, SK

The History of Ham Radio

Parts 7 and 8: Broadcast radio and the early '20s.

In the early 1920s, what effect did the emergence of radio broadcasting have on the amateur radio operator? Could it have been that he was directly responsible for the great popularity of this new entertainment field? Was amateur radio in some measure the instigator?

In 1919, Frank Conrad 8XK, one of our enthusiastic wireless amateur pioneers living in Pittsburgh, used his amateur station to entertain nearby listeners with musical renditions. He used an ordinary telephone mouthpiece as a microphone. This same station, with several modifications, went on the air as KDKA on November 2, 1920, known as the Westinghouse Pioneer Broadcaster.

Early broadcasting

History records that, as far back as 1910 and 1911, there were voice-modulated signals heard via wireless. These emanated from early experiments with the quenched arc-gap transmitters. Dr. Lee DeForest, the well-known inventor of the triode, had a voice-modulated vacuum tube circuit in operation in his laboratory in these early years.

With wireless broadcasting ushering in a complete new mode of living for millions, the old system of dots and dashes had to give ground to modulation of the ether waves by voice and music. Normal amateur communication now had company, as the general public suddenly took a fancy to this mysterious phenomenon. Such desirable services as weather and market reports, now via wireless, became an essential part of the daily menu for listeners — especially the farmers and the country folks. A new and exciting national pastime was ushered into being.

In the fall of 1920, station KDKA announced the first nationwide election returns of the Harding-Cox presidential contest. The immediate result of the over-the-air broadcast was hundreds of requests, directed to the Department of Commerce, for broadcasting station licenses. There could be no doubt that the entertainment factor suddenly stemming from dozens of stations would take over the airwaves. Experimenters, many companies, private organizations, and even individuals vied with each other to jump in and broadcast something, just to be heard.

Licensing

In the very beginning, the Commerce Department made available three general types of license permits. These were:

9XAF — experimental, designated by an X prefix;

9YAN — institutional and training school, a Y prefix; and

9ZHB — clubs and private organizations, a Z prefix.

The assigned frequency depended somewhat on the type of program the station intended to put on the air. The department issued such licenses for only three-month periods at a time. As the number of requests to broadcast mushroomed, all licenses to broadcast had more extended periods and were designated with either a W or a K prefix.

Amateur radio operators as broadcast listeners

There was no doubt that this newly discovered scientific wonder of broadcasting via radio had the amateur wireless operator deeply involved. He was found in the forefront of all the activity. With his innate knowledge of radio's mystery, he formed the nucleus

---

Reprinted from *73 Amateur Radio*, November 1978 and May 1979, where this was originally reprinted from *QCC News*, a publication of the Chicago Area Chapter of the QCWA.

of the listening public. He was in great demand to supply the information and, what then became necessary, the receiving devices, to the non-amateur public. There soon appeared the first one-tube "music box," equipped with a pair of earphones or just a single earpiece. Where distance from the transmitter was short, many early listeners used ordinary crystal detectors. The music box became an addition to the household, often replacing the phonograph and/or the piano for the evening's entertainment. Concerts, lectures, recitals, and news were there to enjoy as these events took place. Naturally, these sudden changes thrust upon an unsuspecting public brought about an almost revolutionarily altered standard of living.

Major problems in the overall radio field developed because of the wavelength allocations for hundreds of domestic stations that were clamoring for space in the ether spectrum.

Toward the end of 1921, the Department of Commerce was compelled to appoint a committee to try to devise a new code of on-the-air ethics. This was an attempt to correct a situation brought about by radio phone, something which could not have been foreseen in the original established laws of 1912.

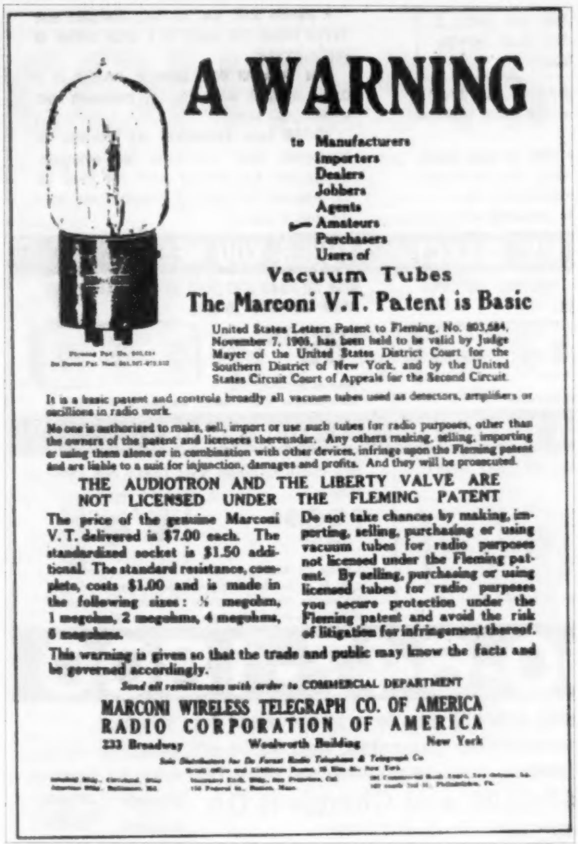
Now two important matters came up for consideration: (1) regulating amateur broadcasting, and (2) solving interference problems between amateur transmissions, commercial broadcasting, and the novice listener.

In January 1922, Herbert Hoover, secretary of the Commerce Department, introduced proposed radio legislation requiring all transmitting stations used for broadcasting news, concerts, lectures, and similar programs to employ limited commercial license operators at the controls and to adjust wavelengths to 360 meters, with 485 meters to be used for issuing crop reports and weather forecasts.

Although the regulations issued by the Commerce Department were only temporary, they did cause concern among radio amateurs. They felt that some of their legitimate services were being curtailed, whereas the department always recognized the great national asset represented by amateur activities. With the phenomenal growth of broadcasting, however, it became necessary to regulate operations before the situation got completely out of hand. It was reasoned that, as long as the general public interest was being served, broadcasting had to continue, but not merely to satisfy someone's personal amusement desire. Coupled with miserable plate supplies, some stations severely cluttered up the airwaves. Under these conditions, the amateur 200 meter band became so overloaded that amateurs were finally asked by Secretary Hoover to collaborate and collectively come up with suggestions of their own for regulating the traffic in their own bailiwick. The understanding was clear to all. Between the telegraph and the phone, one necessarily must be subservient to the other. There was grave fear that the parting of the ways for amateur operation was imminent.

The first National Radio Conference

When the first National Radio conference was called in Washington from February 27 to March 2, 1922, there was common agreement among all concerned



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Jobbers
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Amateurs
Purchasers
Users of

Vacuum Tubes

The Marconi V.T. Patent is Basic

United States Letters Patent to Fleming, No. 803,684, November 7, 1905, has been held to be valid by Judge Mayer of the United States District Court for the Southern District of New York, and by the United States Circuit Court of Appeals for the Second Circuit.

It is a basic patent and controls broadly all vacuum tubes used as detectors, amplifiers or oscillions in radio work.

No one is authorized to make, sell, import or use such tubes for radio purposes, other than the owners of the patent and licensees thereunder. Any others making, selling, importing or using them alone or in combination with other devices, infringe upon the Fleming patent and are liable to a suit for injunction, damages and profits. And they will be prosecuted.

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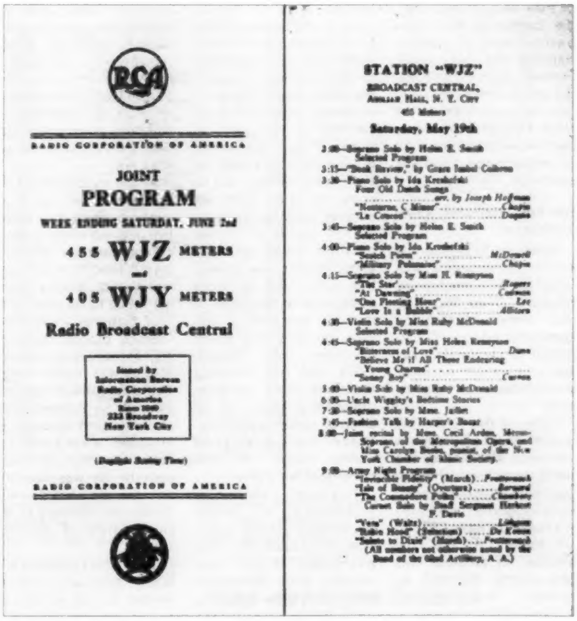
Photo A. *Marconi patent advisory.*



RADIO CORPORATION OF AMERICA

JOINT
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and
405 WJY METERS
Radio Broadcast Central

Issued by
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of America
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New York City

(Daylight Saving Time)

RADIO CORPORATION OF AMERICA

STATION "WJZ"
BROADCAST CENTRAL,
Aeolian Hall, N. Y. City
455 Meters
Saturday, May 19th

Photo B. *RCA's WJZ and WJY broadcast schedule.*

in the final report that was issued: no more phone broadcasts by amateurs.

Although this verdict set certain amateur stations somewhat aback, they did come away from the sessions with a recommended wave assignment extended to a range between 150 and 275 meters. At the conference, an amateur was henceforth defined as follows:

"An amateur is one who operates a radio station transmitting or receiving or both without pay or commercial gain, merely for personal interest or in connection with an organization of like interest."

Amateur phone vs. CW

How did all this change affect the amateur who had used the ether as his own domain for so many years? There was no way in which he could escape this "invasion" of his accustomed privacy. An unavoidable controversy soon developed among the CW and the phone hams. Without customary cooperation, it was recognized that the ether waves were loaded with interference of a new kind. How could the relation between the amateur phone operator and the dot and dash proponent avoid a serious break in the internal ranks, a situation that was evidenced in some *QST* correspondence between the older dyed-in-the-wool amateurs and the newcomers?

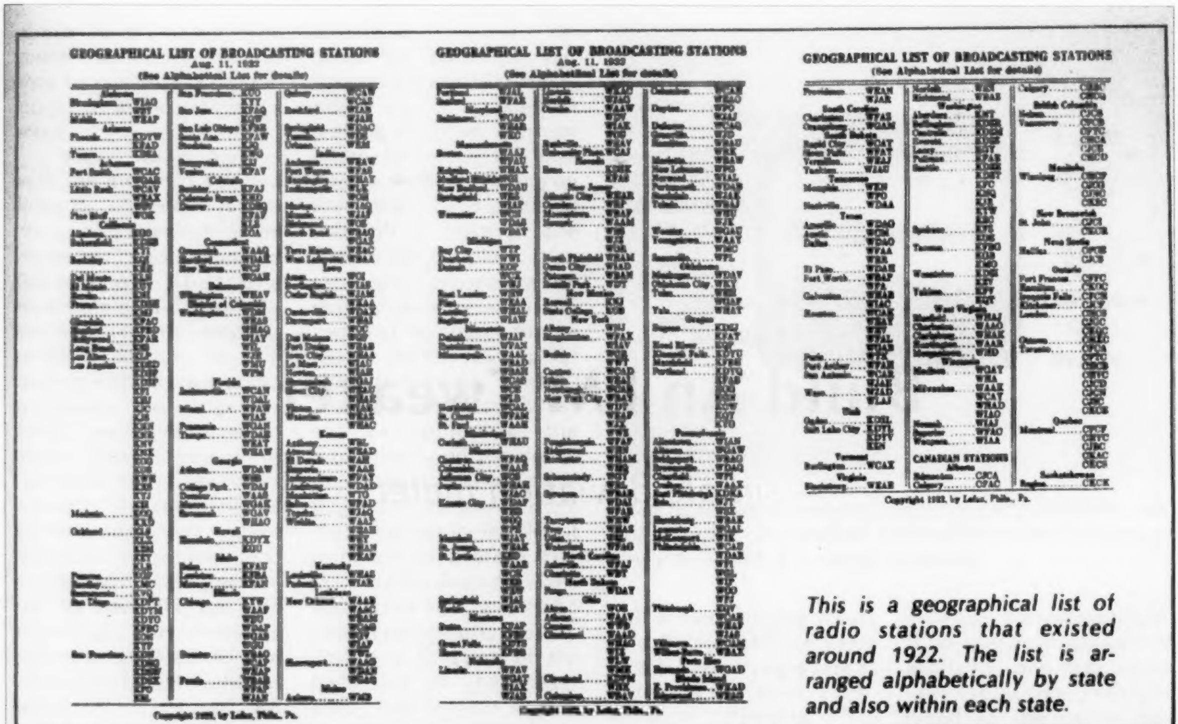
Added to this internal trouble of radio phone vs. code men, wireless had to come to grips with yet another problem, namely, citizen radio as distinguished from amateur radio. Would you believe that *QST* used its front cover page to designate its monthly magazine as follows: "devoted exclusively to *citizen* radio" (August 1922); and the following month it came up with: "devoted exclusively to *amateur* radio" (September 1922)? Typical amateur radio stood at the crossroads for a time.

To minimize chaotic interference, all phone broadcasts, those operating on virtually the same wavelength as the code stations, soon discovered that they were jamming each other unmercifully. What was pleasure turned into bedlam. All early courtesies of the ether waves, which had become recognized, were discarded and forgotten. To the technician who operated on phone, the code man was visualized as an ignorant brasspounder. Among the old-time CW amateurs, it was suggested that the phone man join a radio club or visit another station and observe what was going on among us "amateurs."

The need for order

By the fall of 1921, the radio telephone had heavy competition. There was the commercial broadcaster, the amateur broadcaster, the code man, and the many thousand helpless novice listeners. The various problems that developed were rapidly becoming more serious to amateur radio. Also apparent to everyone was the sudden upheaval in the transgression of existing legislation to control transmitters. For a number of years, as no consideration had been given toward initiating revisions in the old 1912 law.

At the conclusion of the conference, all amateurs were informed that, effective



GEOGRAPHICAL LIST OF BROADCASTING STATIONS
Aug. 11, 1922
(See Alphabetical List for details)

GEOGRAPHICAL LIST OF BROADCASTING STATIONS
Aug. 11, 1922
(See Alphabetical List for details)

GEOGRAPHICAL LIST OF BROADCASTING STATIONS
(See Alphabetical List for details)

CANADIAN STATIONS

This is a geographical list of radio stations that existed around 1922. The list is arranged alphabetically by state and also within each state.

Photo C. *This is a geographical list of radio stations that existed around 1922. The list is arranged alphabetically by state and also within each state.*

immediately, a silent period must be observed from 8:00 to 10:30 p.m. daily and during Sunday morning church services. The first National Radio Conference placed commercial broadcasting into the 310 to 435 meter range. The amateur was not only assured his existence, but also came out ahead in the assigned waveband territory in which he could operate. He was asked to so divide his newly designated territory to the satisfaction of all concerned.

The radio conference in Washington was well attended by all parties affected and served to allay a number of conflicts. The regulations proposed were only recommendations to be observed among many interests. All realized that this was no binding law, although it was a hope that all would cooperate. In an attempt to approve wavelengths, however, the allocations came to naught, because the military interests still dominated the deliberations and a tentative international agreement drawn up was promptly repudiated.

Proliferation of broadcasting stations

By April 1922, there were 60 large and powerful broadcasting stations operating on the air, with approximately 500 applications for broadcast licenses pending. Such proliferation of signals emanating from so many stations in the assigned operating spectra, with no binding assigned frequencies, proved chaotic. More hearings were scheduled by the secretary, but, since recommendations did not carry legality, there could be no enforcement, so agreements were not respected.

The amateurs at the conference heard plenty of discussions about giving up spark transmitters altogether in order to alleviate interference. CW had come into its own in many stations. Just one paramount drawback, however, slowed the changeovers. The cost of the higher-power tubes for conversion necessary to compete with the power output of the spark was still a factor. New power supplies required a new approach to deliver a signal. Such costs put a decided crimp into the ham's pocketbook. The time was not ripe for abolishing one system for the other, as much as this was desirable. Patent litigations among the larger companies and corporations hindered many developments in equipment and accessory components, especially in the vacuum tube area, where competition for manufacturing rights was especially keen.

By now, there were approximately 14,000 licensed amateurs in the United States. The American Radio Relay League made a request at one of the regional conventions to lend a helping hand to the many broadcast listeners, who, like the farmer, his family, the grocer, and the banker, had no knowledge of adjusting even the simplest receiver. The receivers available on the limited market in many instances were still so primitive and crudely constructed that selectivity was impossible to attain, making elimination of interference out of the question. The uppermost need for simple workable receivers was at hand. Something practical to place into the hands of the folks who would become the vast audience to monitor and judge the future broadcasting programs on the air beckoned.

* * *

The evolution of radio before, and to a great extent during, the 1918 war year was for the most part in the hands of radio amateurs and the experimenters. The development of the vacuum tube and its utilization required much time for laboratory research. The quenched-gap and crystal detector were still very much in use. Considerable effort was being put forth by commercial companies together with government engineers, notably the Navy, to develop reliable means of generating undamped waves along semi-mechanical electrical lines.

The culmination of these efforts was the Alexanderson alternator, providing high frequency energy with power up to 200 kilowatts to satisfy navigational and overseas communication demands.

Following the evolution of radio art, two major patent-issuing corporations emerged in America, undertaking research toward larger and better vacuum tubes to replace the quenched-gap and the alternator. They were Radio Corporation of America, a group consisting of General Electric Company,

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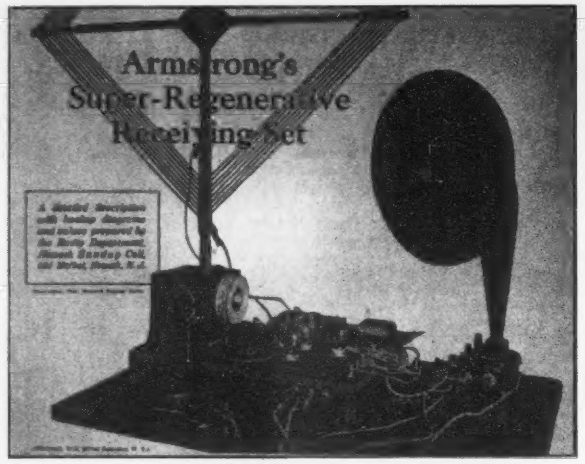


***Photo D.** Armstrong's Super-Regenerative Receiving Set.*

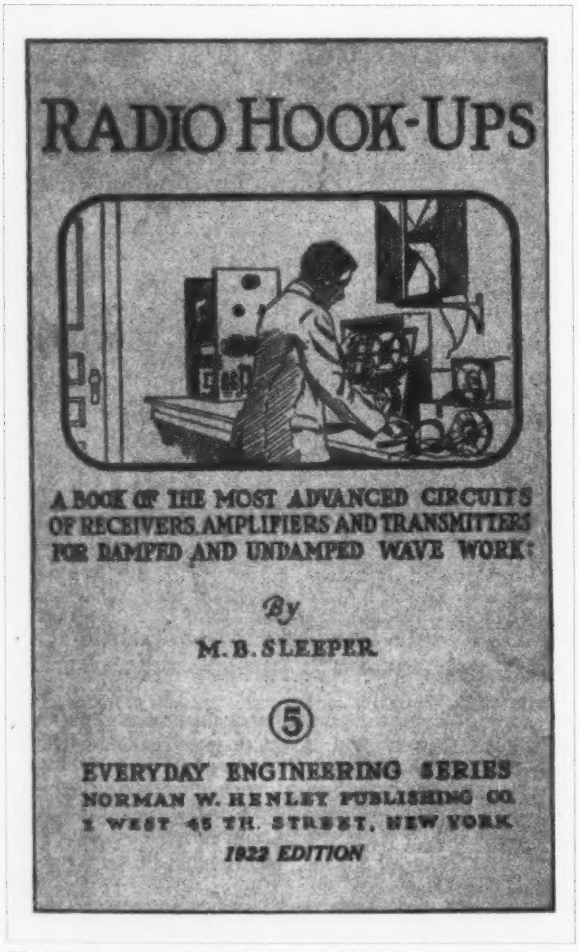
Westinghouse Electric and Manufacturing Company, and American Telephone and Telegraph Company, which pooled patent licenses, and then Hazeltine Corporation, an independent licensing holder. This was a time when many patent applications were flooding the patent office covering circuit designs, and many component parts were entering into the assembly of radio receivers and transmitters. The two companies acted initially as holders of patent rights and issued licenses. Many individuals and small organizations, doing private research, were filing patent applications on hundreds of ideas pertaining to radio, thus leaving the budding industry wide open to massive confusion. The license holders tried to meet this avalanche of new developments by issuing warnings to developers, inventors, and all those who were active in the field, including those who purchased radio parts from dealers and jobbers. The warnings read, "The assembly of a receiver is only for your own private, experimental use, which includes broadcast reception of music and entertainment, not for broadcast transmission and NOT FOR SALE." In other words, licenses had to be obtained first by dealers or jobbers, manufacturers, or assemblers to go into business. With such regulations, back-door trading became commonplace, and many instruments found outlets designed to circumvent the restrictions.

It was to be expected that to satisfy the demand of the listening public, there would be concerns engaged in building and assembling receivers. During this period, it was not possible to standardize any specific design because of the extremely high rate of turnovers and obsolescence. The radio amateur was busily building and assembling sets for his friends and neighbors, who reaped the benefits of his expertise in wireless.

The market mushroomed with the proliferation of broadcast transmitters throughout the United States and the rapidly increasing availability of radio receivers. Improvements in quality and reliability also contributed to lowered costs. Vacuum tubes were produced by the thousands, gradually improving their function but remaining far from being a uniform product. The UV-200 detector and the UV-201 amplifier were the mainstays. All others were either experimental or leftovers from previous designs.

The year 1921 saw a rapid growth of broadcast radio service. Electric manufacturing companies, universities, newspapers, and many individuals obtained permission from the Department of Commerce to become broadcasters. Radio amateurs had permission to transmit news, music, and items of interest over their stations. Broadcasting received the attention and guidance of various government departments. Interest in radio was universal.

This rapid expansion also had its reverse effects. Interest waned when disturbances occurred. The reason —general news and entertaining music was relegated to one wave-length, i.e., 360 meters. Official government stations broadcasting information, weather, and market news were on a wavelength of 485 meters. Not all stations held to these wave assignments accurately. Deviations gave some stations advantages over others. There was not



RADIO HOOK-UPS

A BOOK OF THE MOST ADVANCED CIRCUITS
OF RECEIVERS, AMPLIFIERS AND TRANSMITTERS
FOR DAMPED AND UNDAMPED WAVE WORK:

By
M. B. SLEEPER

⑤

EVERYDAY ENGINEERING SERIES
NORMAN W. HENLEY PUBLISHING CO.
2 WEST 45 TH. STREET, NEW YORK
1922 EDITION

***Photo E.** Cover of* Radio Hook-Ups, *1922 Edition, by M.B. Sleeper* enough room for all to communicate without excessive crossovers. The 1921-1922 receivers were not built to be selective or to avoid overlapping signals. Unless stations geographically close together decided by agreement to broadcast at different times of the day or were located some distances apart, the listener was denied satisfactory reception.

This troublesome problem of interference became so acute that in February, 1922, the Department of Commerce drew up plans which rearranged wavelengths to the broadcaster and to other services as follows:

Public Broadcasting, signifying broadcasting from universities, public institutions, and stations licensed for the purpose of dissemination of information and for educational services, was assigned 485 to 495 meters.

Private Broadcasting, signifying broadcasting by a newspaper, private or public organization, or person licensed for that purpose, including amateurs, was assigned 100 to 150 meters and 285 to 485 meters.

Other wavelengths were intended for commercial ship to shore and overseas communication.

General broadcasting stations were on wavelengths sufficiently different so as not to be heard when a receiving set was tuned to another station. This was to be determined by the broadcaster himself, using his own equipment. Amateurs were supposed to operate mostly late at night, using wavelengths below 275 meters. The early receivers had practically no selectivity. They were very broad tuning, unstable, and consumed a great deal of energy, operating from dry cells and storage batteries. Radio receivers which could be operated from the standard 115-volt circuit had not yet arrived.

In 1914, Major Edwin H. Armstrong invented a radio receiver circuit known as the regenerative circuit. He obtained a patent from the government on October 6, 1914. This circuit described the use of the vacuum tube in a detector-oscillator combination. Vacuum tubes were at that time only in the experimental stage, crudely constructed, unreliable, and not readily available. Consequently, very little development took place before 1917 to test the unique application of the Armstrong circuit wireless signal reception.

The regenerative principle in the circuit is most simply described by stating that when energy is applied at the input terminals of a circuit connected to a vacuum tube in oscillation, the circuit presents either a more negative or a more positive reaction. The objectionable feature of a regenerative circuit was self-oscillation, which was uncontrollable in the hands of the average user. The whistles and howls coming from the loudspeaker or headphones were shocking and became unbearable.

Under such unstable conditions, the radio amateur came up with novel innovations, especially when tuning to continuous wave signals. When using his audiotron tube or his Marconi, De Forest, Donle, or Connecticut "vacuum bottle" for that critical adjustment to bring the reception under control, the presence of a magnet in the proper vicinity of the tube, held at certain angles to the bulb, would increase the intensity of the signal. Close adjustment of the magnet gave excellent results.

Early in August, 1919, the De Forest Company announced one of the first receivers for the monitoring of phone and/or continuous wave signals. It covered 160 to 450 meters and was designated the three-coil ultra-audion. It was designed as a short-wave regenerative

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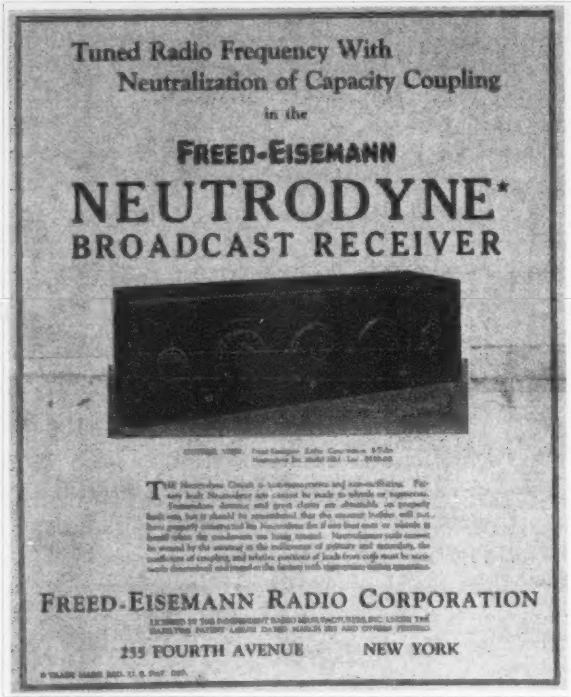

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in the
FREED-EISEMANN
NEUTRODYNE*
BROADCAST RECEIVER

FREED-EISEMANN RADIO CORPORATION
255 FOURTH AVENUE NEW YORK

Photo F. *Well-known in 1922, the neutrodyne receiver was designed around a non-regenerative and non-oscillating configuration. This circuit did not emit objectionable whistles when properly constructed and assembled.*

instrument composed of a series of individually-wired sections and was hooked up as a composite assembly. Hardly a receiver for use by the general public.

Receivers could be assembled following the circuits illustrated in handbooks like the one issued by M. B. Sleeper entitled *Radio Hook-Ups*. The illustrations basically used a coil or two, a tuning condenser, and either a crystal or vacuum tube detector plus a pair of headphones. The tubes available were leftovers, designed during the war by French, German, English, and American laboratories.

They were not very reliable and rarely gave uniform results. It was not uncommon to find a back-room laboratory coming up with some exotic tube design. The intent was to try to improve such undesirable characteristics as excessive filament current drain, objectionable interelectrode capacitances, and short-lived filament emission.

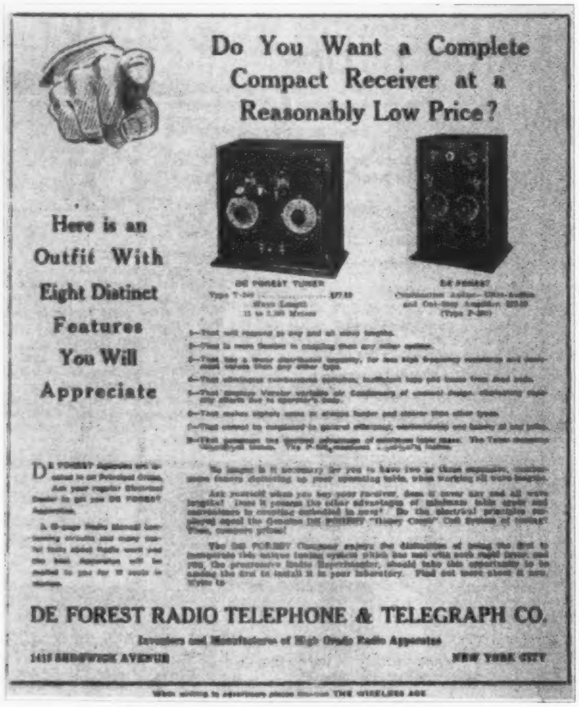

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Photo G. *In August, 1919, the De forest company announced one of the first receivers for monitoring phone and/or CW signals.*

The radio literature of the 1920s carried instructions on how to assemble receivers utilizing various types of coils (these included universal, honeycomb, unilateral, duo-lateral, bi- and multi-lattice), tuning condensers (of the straight line wave-length, straight line frequency, book-type design), variometers, and variocouplers tied to a vacuum tube or two in cascade.

In 1920, the radio amateur and the avid listener had available receivers manufactured under license. They were known as Grebe CR instruments. These receivers were not the type to place into the hands of the uninitiated. They were meant for the radio amateur and experimenter.

For short-wave reception, which included broadcast, the internal capacity of the tube proved a bar to any straightforward solution. Realizing that the vacuum tube was at the heart of the problem, Major Armstrong came up with a solution in the circuit principle named the heterodyne and super-heterodyne. It is based on the mixing together of two frequencies in order to produce two frequencies which are equal to the sum and difference of the other two. In so doing, an intermediate frequency was produced which could be more effective and responsive to the characteristics of the available tube. The resultant amplification was a comparison of the voltage applied to a second detector in the circuit to that of the incoming terminal voltage.

A receiver built along these lines required a series of 6 to 8 tubes and gave excellent amplification. It required skilled manipulation of the controls, since adjustments had to be made at numerous positions to track the frequencies of the incoming signal. Sensitiveness of the superheterodyne receiver was proven by Paul Godley while at Androsen, Scotland, in December, 1920, when he logged numerous American stations during the transatlantic initial DX contest, related in part 5 of "The History of Ham Radio."

In analyzing the various circuit combinations of the heterodyne, it was found that the operation of the system proved a little too critical, especially since, to avoid interaction, individual tubes were required for detection and for rectification. As a result, tuning became more complicated. Engineers remarked that if some way could be found for tuning adjustments to be set and sealed in the laboratory by skilled engineers leaving relatively simple adjustments to the operator, the receiver would be the ideal.

The main difficulty which had to be overcome was the instability from the combination of high amplifications desired. The solution hinged on overcoming the generated oscillations when the number of tubes of the 1921–1922 vintage were hooked to one another in cascade. Much effort was expended in designing intertube transformers of air-core, special iron-core, special couplings, and windings, to balance the impedances from stage to stage. Instability was the problem, again depending on the tubes available.

Well known, in 1922, was a receiver called the neutrodyne. It was designed around a non-regenerative and non-oscillating configuration. When properly constructed and assembled, the one thing this circuit did not do was emit objectionable whistles. The neutrodyne relied on straightforward cascade amplification of the incoming signal. It started with one or two stages of radio frequency amplification, then detection and reinforcement with one, two, or even three stages of audio frequency amplification. It was a popular receiver in its day. The set suffered from an undue amount of internal noise, generated and amplified due to mis-matched component parts, internal tube disturbances, and lack of sufficient tuning controls to balance out the inherent design faults.

About this time in the era of wireless evolution, the amateur's thoughts were directed toward mobile and portable gear.

QRP Asylum Update

continued from page 26

Wes Hayward W7ZOI and Jeff Damm WA7MLH, Technical Correspondence, *QST*, November, 1989. Discussion on MOSFET power amplifiers.

Minnesota QRP Club [http://www.qsl.net/mnqrp/].

Norcal QRP Club [http://www.fix.net/~jparker/norcal.html].

Radio City, 2663 County Road I, Mounds View, MN 55112. 1-800-426-2891. [www.radioinc.com].

Radio Shack, [www.radioshack.com].

Radio Society of Great Britain, [http://www.rsgb.org].

Ramsey Electronics, 793 Canning Parkway, Victor, NY 14564. (716) 924-4560. [http://www.ramseyelectronics.com]

73 Amateur Radio Today Magazine, 70 Hancock Road, Peterborough, NH 03458-1107.

Solid State Design for the Radio Amateur, Wes Hayward and Doug DeMaw, ARRL, 3rd Printing, 1995. ISBN 087259-040-2.

Technical Topics Scrapbook, 1990-1994, Pat Hawker G3VA, Radio Society of Great Britain, 1999. ISBN 1-872309-51-8.

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W1FB's Design Notebook, ARRL, 1st Ed., 2nd Printing, 1994. ISBN: 087259-320-7.

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Your Long-Lost Transistor Notebook

continued from page 30

Working with transistors is a lot of fun when you understand how they are going to react to a stimulus. During the course of our tour you will gain the understanding and insight to design and analyze a circuit using "tools" developed during the tour.

Sort out your transistors and begin collecting data on each type. Part 2 in your "Notebook" will begin with plotting the data that you've recorded using the data format shown in **Table 1**.

Read All About It!

continued from page 35

(another Mark I) in February of 1951, three months before the UNIVAC.

So, who built the first digital computer? I guess it's not so simple a question as, "Who invented the light bulb?"

What's in a name?

- Pick any field of study you like, and chances are the ancient Greeks originated it. The word for our technology, electronics, comes from the Greek elektra, meaning amber. Amber is the dark translucent yellow substance obtained when tree sap hardens — an early plastic, if you will. When amber was rubbed with lamb's wool, the Greeks noticed the clinging phenomenon familiar to any modern who has ever taken a piece of nylon clothing out of a dryer. Ben Franklin and others picked up this investigation of electrostatics 2,000 years later, with results known to us all.

The words electric and electron were widely used in the first decades of the twentieth century, but the word electronics, implying applications of the vacuum tube beyond the original radio area, did not gain currency until a magazine bearing that name appeared in 1930.

- Lee De Forest, inventor of the triode vacuum tube, called his invention the audion — a contraction of audio and ion. He remained convinced that its operation depended on ionized gas inside the bulb long after nearly everyone else had recognized the need for a near-perfect vacuum. DeForest also used the term "wing" for the element which everyone now calls the plate. Of course, Ambrose Fleming, who invented the vacuum diode, called it a valve, and the British continue to say "valve" where we would say "tube" — such are national loyalties.

- The word transistor was coined as a contraction of transfer resistor. Transfer is an engineering term implying a relationship between an electrical output quantity and an input voltage or current. The idea was that an input current would control an output resistance. The term is not a good one, because the transistor's output characteristics are not at all like those of a resistor. Doubling the collector voltage does not double the collector current, for example; it hardly changes collector current at all.

- We call a three-terminal variable resistor a potentiometer because an early version of this device was used in a potential-measuring circuit. A known voltage was voltage-divided down to exactly balance the unknown voltage, as indicated by zero reading on a galvanometer. Today, of course, a "pot" is but seldom used in a potentiometer circuit.

- No naming question generates so much heat on Internet newsgroups as the BNC connector. Some say it means British Naval Connector, while others insist it stands for Baby N-series Connector. One authoritative-sounding post said it simply recognizes the style and designers: Bayonet Neill Concelman.
- There is less controversy over the XLR mic connector. X is simply the manufacturer's series, L denotes a newer Locking version that won't fall out, and R is for the Rubber inset for the pins, replacing the hard plastic, which resulted in pin damage.
- National Radio's famous top-of-the-line receivers, beginning in the '30s and culminating in the '60s, were named the HRO series. An old-timer at the company related that the original production run was done under pressure approaching panic — it was a Hell of a Rush Order. I can believe such flippancy, because when I worked for an elevator company the prototype for a certain controller was built on a wooden frame. Someone had scribbled the size of a saw cut on one of the boards: 4 x 5 inches. It became known throughout the industry as the 4XS controller.

CALENDAR EVENTS

continued from page 37

Amateur Radio Assn., Inc., P.O. Box 528, Englewood NJ 07631-0528 USA. A #10 size SASE should be included for results. (8) Stations planning active participation in New Jersey are requested to advise EARA by August 1st of your intentions so that plans can be made for full coverage from all counties. Portable and mobile operation is encouraged.

HAMSATS

continued from page 39

During the early "NOCALL" packet days I used a Kenwood TD-D7 HT with an antique hand-held Poqet PC to successfully send numerous unconnected packets through the ARISS TNC. I did have the advantage of a 14-element circularly-polarized crossed yagi, though. For the packet configuration I only needed to set a few items in the HT's internal TNC. I set MYCALL W5ACM-2 and UNPROTO EL29EQ VIA NOCALL, ANDY,STEX. I then went to CONVERS mode and started transmitting on the packet uplink when the space station was over my horizon. The unique UNPROTO setting allowed my unconnected packets to be digipeated via NOCALL, and when they did, other Earth stations would see my grid locator EL29EQ, along with my name and general location in Texas. The NOCALL problem won't be around long, but it was good fun to communicate via NOCALL in space while it lasted.

Even with their extremely busy schedules on the space station, the astronauts seem to find more time for ham activities the longer they are in orbit. Plot some orbits, or at least set up a scanner to monitor 145.80 MHz. MIR lasted 15 years, and Space Station Alpha's operations have only begun. In the near term we will have voice, packet and multimode SSTV on 2 meters and 70 cm. Later activities will include more modes and even HF operation.

THE DIGITAL PORT

continued from page 42

laptop. I have programs that won't even open on my 120 MHz laptop.

However, he did qualify the PSK31 module as needing a Pentium 90 or better. Well, most of the computers with the needed soundcard have at least a low end Pentium. Rick added that the LogWindows program would run on a 386 with Windows 3.1 and subsequent faster machines with Windows versions to the present.

One of the secrets of this success story is the use of (an effort) C and C++ programming. There are some very nice working programs written in Visual Basic, but many of these will slow down, perform poorly and crash often when put in the slower hardware environment. There is a difference.

So you should be able to assemble a genuine whiz-bang, high-duty, do-everything computer coordinated station with the least outlay, especially in the computer department. A little software will do for most of your needs, and possibly a soundcard and a little additional cabling can do wonders.

There are a lot of things happening on the digital front in ham radio. This is only one of the interesting happenings. I see several more developments coming up that will make good fodder for the next few months. I don't see a slowdown in the creative imaginations of those who are keeping this digital revolution going.

That will have to do for this month. If you have questions or comments about this column, E-mail me [jheller@sierra.net]. I will gladly share what I know or find a resource for you. For now, 73, Jack KB7NO.

HOMING IN

continued from page 46

display installations. E-mail and postal mail addresses are at the beginning of this article, as is the URL for the "Homing In" Web site. There you'll find lots of information about transmitter tracking in the USA, plus a link to the Amateur Radio Club of Nottingham site for more news of radio foxhunting in England.

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ON THE GO

continued from page 47

is only 738K, but I don't think I'd want to have a large collection of maps loaded at all times.

With more public service and weather communications occurring via APRS, the ability to set up a station quickly and easily or even carry one with you enhances our ability to be a communications resource. This program moves APRS to its next logical level. This definitely is another fun aspect to the hobby that has some real practical implications as well. If you are into APRS, or have been tempted to try it, pocketAPRS will be well worth your time.

QRX

continued from page 6

E5A Characteristics of resonant circuits: Series resonance (capacitor and inductor to resonate at a specific frequency); parallel resonance (capacitor and inductor to resonate at a specific frequency); half-power bandwidth.

E5B Exponential charge/discharge curves (time constants): definition; time constants in RL and RC circuits.

E5C Impedance diagrams: Basic principles of Smith charts; impedance of RLC networks at specified frequencies; PC-based impedance analysis (including Smith Charts).

E5D Phase angle between voltage and current; impedances and phase angles of series and parallel circuits; algebraic operations using complex numbers: rectangular coordinates (real and imaginary parts); polar coordinates (magnitude and angle).

E5E Skin effect; electrostatic and electromagnetic fields.

E5F Circuit Q; reactive power; power factor.

E5G Effective radiated power; system gains and losses.

E5H Replacement of voltage source and resistive voltage divider with equivalent voltage source and one resistor (Thevenin's Theorem).

E5I Photoconductive principles and effects.

Subelement E6 — Circuit Components
[5 Exam Questions — 5 Groups]

E6A Semiconductor material: Germanium, Silicon, P-type, N-type; Transistor types: NPN, PNP, junction, unijunction, power; field-effect transistors (FETs): enhancement mode; depletion mode; MOS; CMOS; N-channel; P-channel.

E6B Diodes: zener, tunnel, varactor, hot-carrier, junction, point contact, PIN and light emitting; operational amplifiers (inverting amplifiers, noninverting amplifiers, voltage gain, frequency response, FET amplifier circuits, single-stage amplifier applications); phase-locked loops.

E6C TTL digital integrated circuits; CMOS digital integrated circuits; gates.

E6D Vidicon and cathode-ray tube devices; charge-coupled devices (CCDs); liquid crystal displays (LCDs); toroids: permeability, core material, selecting, winding.

E6E Quartz crystal (frequency determining properties as used in oscillators and filters); monolithic amplifiers (MMICs).

Subelement E7 — Practical Circuits
[7 Exam Questions — 7 Groups]

E7A Digital logic circuits: Flip-flops; astable and monostable multivibrators; gates (AND, NAND, OR, NOR); positive and negative logic.

E7B Amplifier circuits: Class A, Class AB, Class B, Class C, amplifier operating efficiency (i.e., DC input versus PEP), transmitter final amplifiers; amplifier circuits: tube, bipolar transistor, FET.

E7C Impedance-matching networks: Pi, L, Pi-L; filter circuits: constant K, M-derived, band-stop, notch, crystal lattice, pi-section, T-section, L-section, Butterworth, Chebyshev, elliptical; filter applications [audio, IF, digital signal processing (DSP)].

E7D Oscillators: types, applications, stability; voltage-regulator circuits: discrete, integrated and switched mode.

E7E Modulators: reactance, phase, balanced; detectors; mixer stages; frequency synthesizers.

E7F Digital frequency divider circuits; frequency marker generators; frequency counters.

E7G Active audio filters: characteristics; basic circuit design; preselector applications.

Subelement E8 — Signals and Emissions
[4 Exam Questions — 4 Groups]

E8A AC waveforms: sine wave, square wave, sawtooth wave; AC measurements: peak, peak-to-peak and root-mean-square (RMS) value, peak-envelope-power (PEP) relative to average.

E8B FCC emission designators versus emission types; modulation symbols and transmission characteristics; modulation methods; modulation index; deviation ratio; pulse modulation: width; position.

E8C Digital signals, including CW; digital signal information rate vs bandwidth; spread-spectrum communications.

E8D Peak amplitude (positive and negative); peak-to-peak values: measurements; Electromagnetic radiation; wave polarization; signal-to-noise (S/N) ratio.

Subelement E9 — Antennas And Feed Lines
[5 exam questions — 5 Groups]

E9A Isotropic radiators: definition; used as a standard for comparison; radiation pattern; basic antenna parameters: radiation resistance and reactance (including wire dipole, folded dipole), gain, beamwidth, efficiency.

E9B Free-space antenna patterns: E and H plane patterns (i.e., azimuth and elevation in free-space); gain as a function of pattern; antenna design (computer modeling of antennas).

E9C Phased vertical antennas; radiation patterns; beverage antennas; rhombic antennas: resonant; nonresonant; radiation pattern; antenna patterns: elevation above real ground, ground effects as related to polarization, take-off angles as a function of height above ground.

E9D Space and satellite communications antennas: gain; beamwidth; tracking; losses in real antennas and matching: resistivity losses, losses in resonating elements [loading coils, matching networks, etc. (i.e., mobile, trap)]; SWR bandwidth; efficiency.

E9E Matching antennas to feedlines; characteristics of open and shorted feedlines: 1/8 wavelength; 1/4 wavelength; 3/8 wavelength; 1/2 wavelength; 1/4 wavelength matching transformers; feedlines: coax versus open-wire; velocity factor; electrical length; transformation characteristics of line terminated in impedance not equal to characteristic impedance; use of antenna analyzers.

FISTS Fighting

Don't look now, but Morse advocates are far from giving up on the code, and their organized advocacy continues to grow. For example: FISTS is the worldwide group dedicated to the preservation and use of code in the amateur radio bands. It now has member services that include a regular newsletter called *Keynote* and a QSL bureau for the exchange of cards between FISTS members — who now number almost 5,000.

Thanks to Q-News, *via* Newsline, *Bill Pasternak WA6ITF, editor.*

Gumming In

Now comes this bit of news from across the Pacific, where a Japanese dentist recently invented a way to implant a microchip locator into false teeth. The microprocessor can be detected with a radio transceiver, enabling the denture wearer to be gummed ... er ... homed in on and identified.

Why do this, you ask? Well, it seems that some medical facilities such as senior citizens' homes collect dentures from their owners after each meal. They then wash all of them together. The inventor says that his micro implant would ensure that the correct set of dentures goes back to the rightful owner.

Now that's a plan with some teeth in it!

Thanks to Q-News, *via* Newsline, *Bill Pasternak WA6ITF, editor.*

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The Doldrums

Signal absorption during the day and atmospheric static at night are the hallmarks of July, placing it at the heart of the "summer doldrums" — a very challenging period for DXers. Expect intense noontime ionization to weaken signals on 10 through 20 meters, and heavy atmospheric static to limit nighttime activity on 30 meters and above. Although early mornings, late afternoons, and evenings will provide workable HF on at least half the days this month, plan on consoling yourself with other activities occasionally.

Despite this less than enthusiastic outlook, and what you may have inferred from my calendar, there is reason for a little cautious optimism: We are in a peak month in a peak year of Solar Cycle 23. In other words, "Thar's gold in them thar hills" — but it will take some effort and a little luck to uncover.

By definition, a peak in the solar cycle means that we have a large average daily number of sunspots, and these are closely related to increased levels of ultraviolet radiation. As all licensed radio operators should remember, ultraviolet radiation causes the gases in our upper atmosphere to become ionized, forming the HF-reflective ionosphere. As a rule, greater ionization means greater reflectivity and better propagation.

Another benefit of a strong ionosphere is its increased resistance to disruption. When ionization is high, only the larger solar events will appreciably effect radio propagation. My point is, there is almost always something workable during solar maximum no matter how bad things are, and if the bands do go totally haywire, they usually recover quickly. A vivid demonstration of this occurred in mid-April, when the Earth passed through the intense particle stream of an X14 flare, the second largest recorded in a decade. Although there was an abrupt worldwide HF blackout, communications were back to "normal" within 12 hours. If the ionosphere had been weak at the time the blackout might have lasted for several days.

Admittedly, there is a drawback to having a really strong ionosphere, and that is the problem of noontime signal absorption as the Sun passes through its zenith each day. While this is a moderate annual phenomenon, the problem is greatly exacerbated every eleven years or so when sunspot activity reaches a maximum. Fortunately, there is a positive aspect to this and that is where the

July 2001						
SUN	MON	TUE	WED	THU	FRI	SAT
1 F-P	**2** F	**3** F-G	**4** F-G	**5** F-P	**6** F	**7** F-G
8 F-P	**9** F	**10** F-G	**11** G	**12** F-P	**13** P	**14** F-P
15 F-P	**16** P	**17** F-P	**18** F	**19** P	**20** F	**21** F-P
22 F	**23** F-P	**24** F	**25** F-G	**26** F-P	**27** F-P	**28** P
29 P	**30** F-P	**31** F				

GMT	00	02	04	06	08	10	12	14	18	16	20	22
EASTERN UNITED STATES TO:												
Central America	15-20	(15) 30	20 (40)	(20-40)	x	(20)	20	(20)	(15)	(15)	15 (20)	(10) 17
South America	15 (20)	(15) 20	20 (40)	(20-40)	(20)	x	(15)	(15)	x	(10)	(10-20)	(10) 20
Western Europe	20	20	(20-40)	(40)	x	(20)	x	x	x	x	(20)	20
South Africa	x	(40)	x	(20)	x	x	x	x	(15)	(15)	x	x
Eastern Europe	20	20 (40)	(20)	x	x	x	(20)	x	x	(15)	(15)	(20)
Middle East	20	20 (40)	(20)	x	x	x	x	x	x	x	(20)	(15)
India/ Pakistan	(15-20)	(20)	x	x	(20)	x	x	x	x	x	x	x
Far East/ Japan	(15)	x	x	x	x	x	(20)	(15-20)	(15)	x	x	(15)
Southeast Asia	(15-20)	x	x	(20)	x	x	(20)	x	x	(15)	x	x
Australia	(15)	(15)	x	x	(20-30)	(20-30)	(20)	(20)	x	x	x	x
Alaska	(15-20)	(15-20)	(15-20)	20	20 (40)	(20-40)	(20)	(20)	x	x	(15)	(15-20)
Hawaii	(15-20)	(15-20)	(15-20)	20	20 (40)	(20-40)	(20)	(20)	x	x	x	(15)
Western USA	(10) 30	(10) 30	(10) 40	(15) 40	(20) 40	(20-40)	(15) 20	(10) 20	(10-20)	(10-20)	(10-20)	(10) 20
CENTRAL UNITED STATES TO:												
Central America	(10) 20	(15) 30	20 (40)	20 (40)	(20-40)	(20)	(20)	(15) 20	(15-20)	(10-20)	(10-20)	(10) 17
South America	10 (20)	(10) 20	(15) 30	(15) 30	(20-40)	(20)	(20)	(15)	(15)	(10)	(10-15)	(10-20)
Western Europe	(15) 20	20	(20-40)	(20-40)	x	(20)	(20)	x	x	x	x	(15-20)
South Africa	x	x	(40)	(20-40)	(20)	x	x	x	(10-15)	(10-20)	(20)	x
Eastern Europe	(20)	(20)	(20)	(20)	x	x	(20)	(20)	x	(15)	(15-20)	(15-20)
Middle East	(15-20)	(20)	(20)	(20)	x	x	x	x	x	x	(20)	(20)
India/ Pakistan	(15-20)	(15-20)	(20)	x	x	x	(20)	x	x	x	x	x
Far East/ Japan	x	(15)	(15)	x	x	(20-40)	(20)	20	(20)	x	x	x
Southeast Asia	(15)	(15)	(15-20)	(20)	x	x	(20)	(20)	(15-20)	(15)	(15)	x
Australia	(15)	(15)	(15)	(20)	20 (40)	(20-40)	(20-40)	20	(20)	x	(15)	x
Alaska	(10) 30	(10) 30	(10) 40	(15) 40	(20) 40	(20) 40	(20-40)	(15-40)	(10) 30	(10-20)	(10-20)	(10) 20
Hawaii	(15-20)	15 (20)	(15-20)	20	20	(20)	20	(20)	x	x	x	(15)
WESTERN UNITED STATES TO:												
Central America	(10) 17	(15) 20	(15) 20	20	(20)	(20)	(20)	(20)	(20)	(10-20)	(10-15)	(15-20)
South America	(10-20)	(10) 17	15-20	(15) 20	(20)	(20)	(20)	(15)	(15)	x	(15)	(10-15)
Western Europe	(15-20)	(20)	20	(20)	x	x	x	(20)	(15)	(15)	(20)	(15-20)
South Africa	x	x	x	(20)	(20)	x	x	(20)	(20)	(15)	x	x
Eastern Europe	(15-20)	(20)	(20)	(20)	x	x	x	(20)	x	x	x	(15-20)
Middle East	(20)	(15-20)	(15-20)	(20)	x	x	x	x	x	x	x	(20)
India/ Pakistan	x	x	(15)	x	x	x	x	(20)	x	(15)	x	x
Far East/ Japan	(15)	(15)	(20)	(20)	(20)	(20-40)	(20-40)	(20)	(20)	(15-20)	x	(15)
Southeast Asia	x	x	(15)	(15)	x	(20)	(20)	(20)	(15-20)	(15-20)	(15)	x
Australia	(10-15)	(10-15)	15	(15-20)	20	20	20	(20)	20	(20)	x	(15)
Alaska	(10) 40	(10) 40	(10) 40	(15) 40	(20) 40	(20) 40	(20-40)	20-40	(15) 40	(10) 40	(10) 40	(10) 40
Hawaii	(10-15)	(10-20)	(10-20)	(15-20)	20	20	(20-40)	20 (40)	(20-40)	x	x	(10-15)
Eastern USA	(10) 30	(10) 30	(10) 40	(15) 40	(20) 40	(20) 40	(20-40)	(15-20)	(10) 20	(10-20)	(10-20)	(10) 20

Table 1. *Band, time, country chart. Plain numerals indicate bands which should be workable on Fair to Good (F-G) and Good (G) days. Numbers in parentheses indicate bands usually workable on Good (G) days only. Dual numbers indicate that the intervening bands should also be usable. When one number appears in parentheses, that end of the range will probably be open on Good (G) days only.*

"gold" is to be found: The E-layer often fails to completely disappear after sundown. Operators with sensitive equipment and properly tuned antennas can often take advantage of this weak-but-steady condition and make some surprising contacts, so don't ignore this possibility when the charts show an apparent lack of usable nighttime frequencies.

Happy hunting, and happy Fourth!

Band-by-Band Summary

10 and 12 Meters

Daytime absorption will weaken signals, but reliable DX contacts may be found in the Caribbean and Latin America, with occasional openings to Africa or Australia. Expect signals to peak in the morning or late afternoon, but don't forget that these low bands could stay open well into the evening at this time of year. Expect short-skip to fall between 1,000 and 2,000 miles.

15 and 17 Meters

Viable DX will be available to many parts of the world. Expect the strongest signals in the early morning or late afternoon. These bands should hold up well into the evening throughout most of the month. Look for short-skip out to 2,300 miles.

20 Meters

Good daytime DX will be possible with the strongest daytime signals occurring shortly after sunrise or in the late afternoon or early evening hours. Some decent nighttime DX will also be possible, especially to the west and northwest. Expect short-skip to vary from 500 to 2,000 miles during the day and from 1,000 to 2,300 miles at night.

30 and 40 Meters

Some good DX is likely to be heard throughout the night as long as atmospheric noise isn't too great, but static from nocturnal thunderstorms will undoubtedly dominate many nights. Good daytime openings should again be found between the coasts and to Alaska, but skip will be limited to 750 miles or so. At night, skip can fluctuate from 500 to over 2,000 miles.

80 and 160 Meters

High static will mask signals on these bands most of the time, but occasional weak openings may occur between sunset and sunrise. Peaks will usually come near midnight and in the predawn hours. Short-skip will vary from 1,000 to 2,000 miles.

NEVER SAY DIE

continued from page 8

couldn't get through to him in Africa to say hello some 25 years later. Well, all I had at the time was a dipole antenna.

Barry Goldwater K7UGA was a good friend. I had lunches with him at the Capitol and dinner with him at his home in Scottsdale. I visited for two weeks with King Hussein JY1 in his summer palace, just outside Amman. And recently I visited with Art Bell W6OBB at his home in Nevada. Oh, yes, I had lunch with Freeman Gosden (Amos, of Amos and Andy), at his home.

Bill Leonard (W2SKE), the head of CBS TV news, and I flew around the world together, working thousands of hams on 20m as we flew, and visiting hams in 23 countries.

Hmm, that's about it. How about you? I admit that being the editor of a ham magazine helped, but what better could a dyed-in-the-wool ham do but be the editor of a ham magazine? Talk about the best in the world of all possible jobs! Nirvana.

Bread

The staff of life, right? No, make that the shaft of life.

Grains make healthy food — when we sprout them, but when we grind them into flour, a process we invented around 10,000 years ago, and which had not existed for 99.999+% of mankind's history, we did not do ourselves any favors.

Robert Crayhon, in his *Paleolithic Diet*, says that the combination of low physical activity, hypercaloric intake, and overconsumption of these neocarbs (new carbohydrates) is at the root of our obesity crisis, plus a long list of other health miseries. His cure is simple — just return to our historical diet of lean meat, seafood, fruits, vegetables, raw nuts, and moderate physical activity.

Our guts over millennia adapted to our eating raw food. Thus, the more you go raw, the healthier you're going to be and the better you're going to feel. You'll lose unwanted weight, have more energy, and even your brain will respond once you stop sandbagging your body with sugar, flour products, and cooked food.

That's right — no pasta, no pizza, no hot dogs, no Big Macs. That is, unless you don't mind being grossly fat, tired all the time, constipaturd, and difficult to live with. Ohh, boy!

I just love the letters and E-mails I'm getting from people who have changed to raw food. They've lost their unwanted weight, and say they're looking and feeling years younger.

Is it really surprising that when you put the wrong fuel into a machine that it's going to work poorly?

In looking through *The Concise Medical Encyclopedia*, a 500-page 1998 book describing thousands of illnesses, I could see that around 99% of these illnesses are caused by a poor diet. And most can be cured by a diet change. It's your health, your body, and your choice.

Con Job!

This whole business of "jobs" is an incredibly enormous con. "Employment" is a scam. You, your folks, and their folks have been conned for the last hundred years or so by the big corporations, the media, our schoolteachers, and the government.

It all started with the industrial revolution, which needed factory workers. They needed to move workers off the farms and onto production lines.

So now we are thoroughly inculcated (brainwashed) into thinking in terms of being workers. Of having jobs. Preferably, secure jobs. We think it's perfectly normal to commute to work on the Long Island Railroad — which I did for almost a year when I worked at Airborne Instrument Laboratories as an engineering project supervisor. I made the hour drive from Brooklyn to Mineola, Long Island, for a while, but at least on the train I could read for an hour. Each way.

Now I see millions of workers driving in heavy traffic to their jobs. It's pathetic! We have people driving two hours into Boston to their jobs every day from New Hampshire. And two hours back, bumper to bumper. Talk about stress! No wonder we're seeing "road rage." And I see this repeated in every city I visit. What does it take to wake people up and realize that they are like oxen in a yoke?

The alternative, you won't be surprised to know, is to own your own business. If your business is at all successful you won't have to commute, you won't have to get permission to take off on a trip somewhere if the fancy strikes. And you will be able to pay yourself whatever the traffic will bear. It makes you feel good when you can pay yourself $500,000 a year. Been-there, done-that.

You don't need any college degrees to run your own business. In fact, a college degree is a serious handicap. That means you've wasted four extremely valuable years and a bundle of money memorizing answers to pass courses which have nothing to do with running your own business. In a year you can learn everything you need to know, with someone else happily paying you to learn.

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NEVER SAY DIE

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Yes, I know I've been writing about this over and over. I even have a $5 book going into the details on the subject. Okay, how many times do I have to write this to get the message across? Please stop being a sucker and working for someone else, complete with commuting. Get the news to teenagers.

Judges' Sweet Deal

Buried in the US Code, 28USC sec. 371 (a) & (b) Article (3) is this gem, in case you're interested in yet another way Congress is spending your tax money for you. District court judges have no retirement or pension plan. Instead, they are appointed for life, so they get their full paycheck, plus benefits, for life — even after they step down. Upon death, under sec. 371 (b) they can assign their paycheck to their wife or a close dependent relative. About four years ago they pushed through a 26% pay increase for themselves to compensate for inflation.

Congress Did It

Maybe you remember the 1990 recession. I sure do. New Hampshire was hit particularly hard, with our unemployment rate making records. What I don't remember ever reading was what caused the recession. How about you?

Donald Trump, who was hit particularly hard by it, going from having several billion to being almost a billion in the red, explained it in his *The Art of the Comeback*. Sherry found the book on sale at a Dollar Store. These stores are springing up everywhere, the 2000s version of the old five-and-dime stores. Well, a nickel in the '30s bought what a dollar does today.

Anyway, what happened was that because of some tax breaks on real estate in the 1980s, developers were building all around the country and banks were doing a land office business with mortgages as real estate values climbed and climbed.

When I sold a bunch of my computer magazines for $16 million in 1983, for tax reasons quite a bit of the money was put into real estate developments. By 1986, at the peak of the real estate boom, Congress decided it was time to rein in developers, so they revised the 1981 tax code with the Tax Equity and Fiscal Responsibility Act of 1986. This not only revised the tax breaks for developers, but was retroactive. My real estate investments, which had been worth millions suddenly were worth virtually nothing. Like this year's dot-com catastrophe.

This was bad enough for business properties, but it also hit the home market, driving home prices down, often far below the mortgage values. It became less expensive to walk away from a house than to keep paying the high mortgage payments, so banks found themselves with rising inventories of vacant homes — and huge losses.

This was when virtually every bank in New Hampshire either went out of business, or was bought for pennies on the dollar by banking conglomerates. And this happened everywhere.

New Hampshire got hit particularly hard because at this same time the microcomputer (the PC) was putting the minicomputer giants out of business.

Thousands of the employees of Digital Equipment, Data General, Wang, Centronics, and Prime lived in southern New Hampshire and commuted to these Boston-area companies.

Not that I hadn't done my best to warn the heads of these companies. I had lunch with An Wang in 1980 and tried to convince him to adapt his office systems to the whole new world of microcomputers. He said I was wrong. I sat down with the other presidents and laid out the future as I saw it, and they all told me I was crazy.

With minicomputers, which a few years earlier had put all but IBM out of the mainframe business, a company wanting to computerize its operation would go to a software developer who would buy the minicomputer from the manufacturer, adapt their proprietary software packages for the customer, and install and maintain the system.

The software usually cost as much as the computer.

Mainframe systems cost about a million dollars, complete with software. Minicomputers cost about $100,000, so they quickly put the mainframe companies out of business. Then, when microcomputers came along with complete systems in the $10,000 range, another 90% drop in cost, I knew minicomputers couldn't last long.

At any rate, Congress managed to put the country into a huge depression for several years, and force thousands of banks out of business. Thanks a bunch, guys.

And what happened to Trump? He got busy making more deals and is doing better than ever.

And what happened to my real estate development investments? Pffft.

Doom!

Ed Dames, a frequent guest on the Art Bell show, did remote viewing for the military for many years. Now he's teaching others how to do it. Ed's been predicting a kill shot to come from the Sun fairly soon, but he's not sure when. This would be a huge flare which would cause a worldwide calamity. That's why he's being called Ed Dooms.

Ed says that the people in the future they were able to remote view were living underground. He also predicted that the calamity would send waves miles high around the globe, with winds in many places over 300 miles per hour. That wouldn't leave much of civilization. Where's my shovel?

My ears perked up when he elaborated on this theme in early March, saying that the killer flare would destabilize the Earth. Hmm, that sounds familiar. That could mean a shifting of the poles, and I don't mean emigration from Krakow and Warsaw.

This is the same prediction made for some time in the next couple of years by Nostradamus, as reported by Dolores Cannon in her *Conversations With Nostradamus*, which I reviewed a while back. He predicted that 97% of the people on Earth would be killed when the Earth shifted on its axis, with the new poles being over Siberia and South America.

Then we have René's *The Last Skeptic of Science*, where he makes a good case for there never having been any ice ages, just pole shifts which have suddenly made new polar regions. This explains why there are places in Siberia and Alaska where there are huge piles of prehistoric animal bones, remnants of some super major catastrophe. It explains why mammoths have been found frozen in Siberia with tropical plants still undigested in their stomachs.

If that's not enough to worry you, then start reading the Edgar Cayce predictions of a pole change coming up in the next few years.

If you are able to snicker all that off, believing that predicting the future is a bunch of baloney, then (a) you've never been to a really good fortune teller, and (b) you're unaware of the work done at the Princeton University PEAR laboratories which has conclusively proven that precognition is a reality. You also haven't read the wonderful book on the subject by Dean Radin, *The Conscious Universe*. Or you're in pathological denial.

Then there's Chet Snow's *Mass Dreams of the Future*. Chet's group hypnotized over 2,500 people, but instead of regressing them to their past lives, they progressed them to future lives. And what they found was that over 95% of them were unable to find a body into which to reincarnate in the 21st century. A few more managed to reincarnate in the 22nd century, and so on. All indicative of some sort of mass human extinction.

Continued on page 64

Wise Up!

Here are some of my books which can change your life (if you'll let 'em). If the idea of being healthy, wealthy and wise interests you, start reading. Yes, you can be all that, but only when you know the secrets which I've spent a lifetime uncovering.

......Wayne

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some serious lifestyle changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No, I'm not selling any health products, but I can help you cure yourself of cancer, heart trouble, or any other illness. Get this new, 2001 expanded edition (156p). $10 (#05)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. $5 (#03)

The Secret Guide to Wisdom: This is a review of around a hundred books that will boggle your mind and help you change your life. No, I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. You'll have plenty of fascinating stuff to talk about on the air. $5 (#02)

The Bioelectrifier Handbook: This explains how to build or buy ($155) a little electrical gadget that can help clean your blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, quickly patented, and hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. It's working miracles! The circuit can be built for under $20 from the instructions in the book. $10 (#01)

My WWII Submarine Adventures: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? How about the Amelia Earhart inside story? If you're near Mobile, please visit the Drum. $5 (#10)

Wayne's Caribbean Adventures: My super budget travel stories – where I visit the hams and scuba dive most of the islands of the Caribbean. You'll love the special Liat fare which let me visit 11 countries in 21 days, diving all but one of the islands, Guadeloupe, where the hams kept me too busy with parties. $5 (#12)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. $5 (#20)

Cold Fusion Journal: They laughed when I predicted the PC industry growth in 1975. PCs are now the third largest industry in the world. The cold fusion ground floor is still wide open, but then that might mean giving up watching ball games. Sample: $10 (#22).

Julian Schwinger: A Nobel laureate's talk about cold fusion—confirming its validity. $2 (#24)

Improving State Government: Here are 24 ways that state governments can cut expenses enormously, while providing far better service. I explain how any government bureau or department can be gotten to cut it's expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy *any* taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. $5 (#30)

Mankind's Extinction Predictions: If any one of the experts who have written books predicting a soon-to-come catastrophe which will virtually wipe most of us out are right, we're in trouble. In this book I explain about the various disaster scenarios, like Nostradamus, who says the poles will soon shift (as they have several times in the past), wiping out 97% of mankind. Okay, so he's made a long string of past lucky guesses. The worst part of these predictions is the accuracy record of some of the experts. Will it be a pole shift, a new ice age, a massive solar flare, a comet or asteroid, a bioterrorist attack? I'm getting ready, how about you? $5 (#31)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the NASA videos, looked carefully at the photos, read the astronaut's biographies, and talked with some readers who worked for NASA. This book cites 45 good reasons I believe the whole Apollo program had to have been faked. $5 (#32)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is what you need to help you reduce stress. Classical music also raises youngster's IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! $5 (#33)

The Radar Coverup: Is police radar dangerous? Ross Adey K6UI, a world authority, confirms the dangers of radio and magnetic fields, including our HTs and cell phones. $3 (#34)

Three Gatto Talks: A prize-winning teacher explains what's wrong with American schools and why our kids are not being educated. Why are Swedish youngsters, who start school at 7 years of age, leaving our kids in the dust? Our kids are intentionally being dumbed down by our school system — the least effective and most expensive in the world. $5 (#35)

Aspartame: a.k.a. NutraSweet, the stuff in diet drinks, etc., can cause all kinds of serious health problems. Multiple sclerosis, for one. Read all about it, two pamphlets for a buck. (#38)

$1 Million Sales Video: The secret of how you can generate an extra million dollars in sales just by using PR. This will be one of the best investments you or your business will ever make. $40 (#52)

Reprints of My Editorials from *73*. Very few things in this world are as we've been taught, and as they appear. I blow the whistle on the scams around us, such as the health care, our school system, our money, the drug war, a college education, sugar, the food giants, our unhealthy food, fluorides, EMFs, NutraSweet, etc.

1996 Editorials: 120 pages, 100 choice editorials. $10 (#72)

1997 Editorials: 148 fun-packed pages. 216 editorials. $10 (#74)

1998 Editorials: 168 pages that'll give you lots of controversial things to talk about on the air. $10 (#75)

1999 Editorials: 132 pages of ideas, book reviews, health, education, and anything else I think you ought to know about. $10 (#76)

2000 Editorials: 76 pages (thinner magazine as a result of our slowly dying hobby). $5 (#77)

Silver Wire: With two 5-in. pieces of heavy pure silver wire + three 9V batteries you can make a thousand dollars worth of silver colloid. What do you do with it? It does what the antibiotics do, but germs can't adapt to it. Use it to get rid of germs on food, for skin fungus, warts, and even to drink. Read some books on the uses of silver colloid, it's like magic. $15 (#80)

Colloid Reprint. April 97 article on a silver colloid maker, history, and how to use the stuff. $5 (#98).

Colloid Kit. Three 9V battery clips, 2 aligator clips & instructions. $5 (#99).

Wayne's Bell Saver Kit. The cable and instructions enabling you to inexpensively tape Art Bell W6OBB's nightly 5-hr radio talk show. $5 (#83)

NH Reform Party Keynote Speech. It wow'd 'em when I laid out plans for NH in 2020, with much better, yet lower cost schools, zero state taxes, far better health care, a more responsive state government, etc. $1 (#85)

Stuff I didn't write, but you need:

NASA Mooned America: René makes an air-tight case that NASA faked the Moon landings. This book will convince even you. $30 (#90)

Last Skeptic of Science: This is René's book where he debunks a bunch of accepted scientific beliefs – such as the ice ages, the Earth being a magnet, the Moon causing the tides, and etc. $30 (#91)

Dark Moon: 568 pages of carefully researched proof that the Apollo Moon landings were a hoax—a capping blow for René's skeptics. $35 (#92)

Dark Moon Video: 222-minute exposé nailing NASA with their own photos. If you've watched the NASA films of the astronauts walking on the Moon you wondered at their weird gate. Wait'll you see it speeded up. It looks exactly like they're running on Earth! They catch NASA in dozens of give aways that the photos and films had to have been faked. $46 (#93)

Travel Diaries: You can travel amazingly inexpensively – once you know the ropes. Enjoy Sherry and my budget visits to Europe, Russia, and a bunch of other interesting places. How about a first class flight to Munich, a rented Audi, driving to visit Vienna, Krakow in Poland (and the famous salt mines), Prague, back to Munich, and the first class flight home for two, all for under $1,000. Yes, when you know how you can travel inexpensively, and still stay in first class hotels. $5 (#11)

73 Writer's Guide: It's easy, fun, can pad your résumé, and impress the hell out of your friends. $0 (#78)

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Barter 'n' Buy

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The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)— comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Hancock Rd., Peterborough NH 03458 and get set for the phone calls. The deadline for the September 2001 classified ad section is July 10, 2001.

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NEVER SAY DIE

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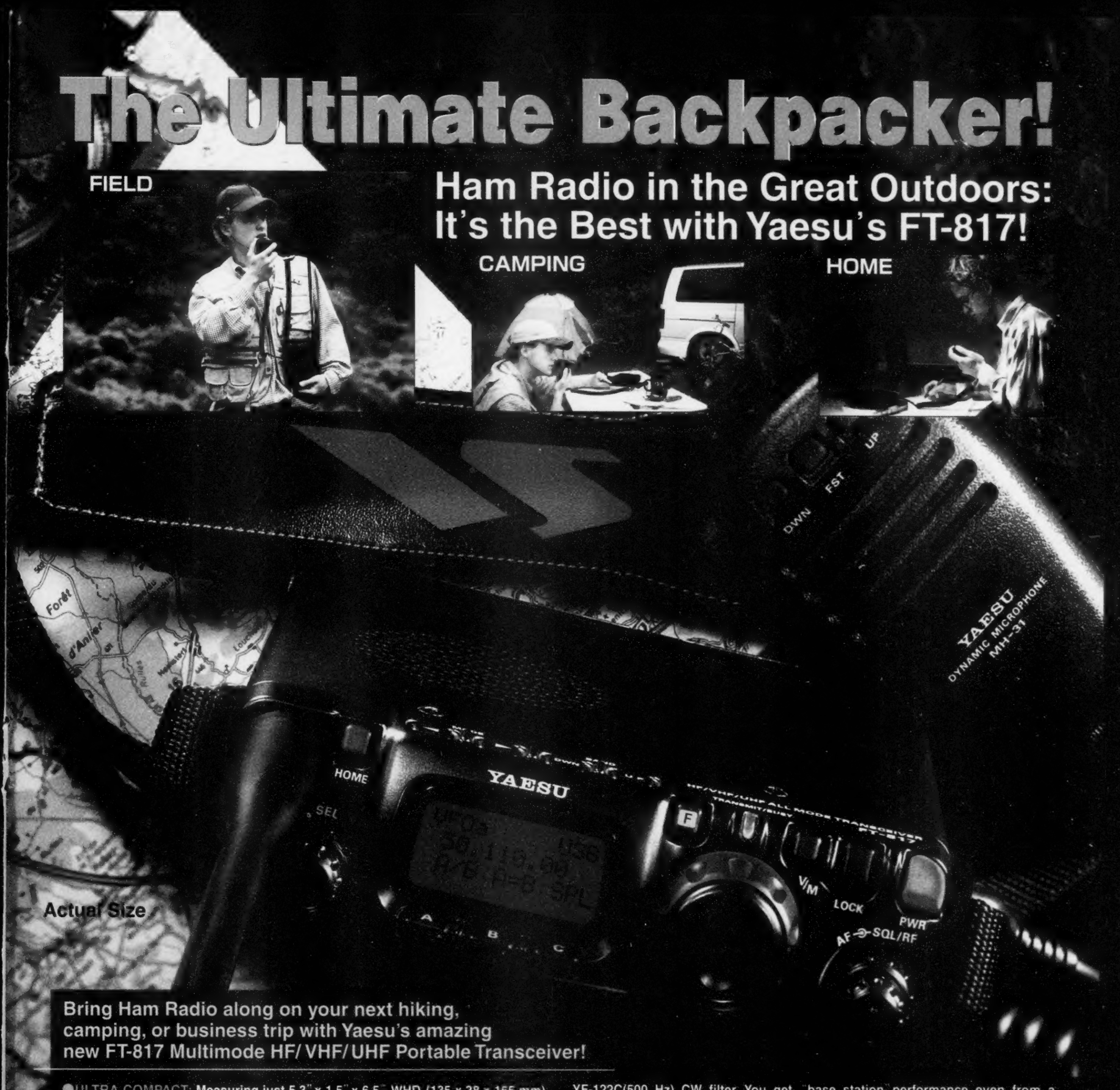
Is it the Inca calendar that ends around 2012?

Dolores has maps Nostradamus drew of the U.S. and Canada after the catastrophe (page 296, volume 2). It looks like my part of New Hampshire might make it. Whew!

Gordon Michael Scallion K1BWC has been predicting a global catastrophe for this same time period. His future map also shows my part of New Hampshire still a land area. Gordon lives not far from me, so that's reassuring.

So what?

Well, if any of these predictions are right, the world's civilizations could soon be wiped out. Winds and earth upheavals would wipe out all of our energy sources. Solar power might survive, once the dust settles, but no more oil, coal, or natural gas. No hydroelectric dams. No power grid. Most roads would be destroyed. Bridges gone. Radio and TV pfft. The only communication there will be in the world will be by amateur radio — if we have emergency power.



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